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(54) 【発明の名称】 電子写真感光体、それを用いたプロセスカートリッジ及び画像形成装置

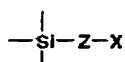
(57) 【要約】 (修正有)

は基である。

【課題】 感光層表面の硬度が高く、耐摩耗性、耐傷性や接着性に優れており、繰り返して画像形成を行った場合、特には高温高湿下で繰り返して画像形成を行った場合でも電子写真性能の疲労劣化を生ずることがなく、ガブリや画像ボケ等を生ぜず良好な画像が安定して得られる電子写真感光体、それを用いたプロセスカートリッジ及び画像形成装置の提供。

【解決手段】 導電性支持体上に、中間層を介して感光層を有する電子写真感光体において、該電子写真感光体の表面層が、下記一般式(1)で示される構造単位を含むシロキサン系硬化樹脂を含有する層であり、該中間層が有機金属化合物及び／又はシランカップリング剤を含有する層であることを特徴とする電子写真感光体。

一般式(1)



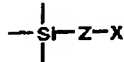
(式中、Xは電荷輸送能付与基であって、該付与基を構成する炭素原子を介して式中のZと結合する基、Zは隣接する結合原子(Si及びC)以外の2価以上の原子又

【特許請求の範囲】

【請求項1】 導電性支持体上に、中間層を介して感光層を有する電子写真感光体において、該電子写真感光体の表面層が、下記一般式(1)で示される構造単位を含むシロキサン系硬化樹脂を含有する層であり、該中間層が有機金属化合物及び／又はシランカップリング剤を含有する層であることを特徴とする電子写真感光体。

【化1】

一般式(1)



(式中、Xは電荷輸送能付与基であって、該付与基を構成する炭素原子を介して式中のZと結合する基であり、Zは隣接する結合原子(Si及びC)以外の2価以上の原子又は基である。)

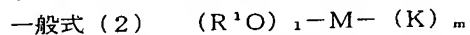
【請求項2】 前記一般式(1)において、Xは電荷輸送能付与基であって、該付与基を構成する炭素原子を介して式中のZと結合する基であり、Zは酸素原子

(O)、硫黄原子(S)又はNR基であり、Rは水素原子又は1価の有機基であることを特徴とする請求項1に記載の電子写真感光体。

【請求項3】 前記中間層に含有される有機金属化合物が金属アルコキシド又は有機金属キレートであることを特徴とする請求項1又は2に記載の電子写真感光体。

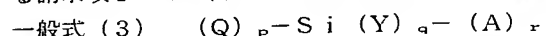
【請求項4】 前記中間層が有機金属キレート及びシランカップリング剤を含有する層であることを特徴とする請求項1～3の何れか1項に記載の電子写真感光体。

【請求項5】 前記中間層に含有される有機金属キレートが下記一般式(2)で示されることを特徴とする請求項3又は4に記載の電子写真感光体。



(式中、R¹はアルキル基であり、Mはジルコニウム、チタニウム又はアルミニウムを表し、キレート形成基Kはアセト酢酸エステル基又はβジケトン残基を表し、l、mは1以上の整数を表す。ただし、Mがジルコニウム又はチタニウムの場合、l+mは4であり、Mがアルミニウムの場合はl+mは3である。)

【請求項6】 前記中間層に含有されるシランカップリング剤が、下記一般式(3)で示されることを特徴とする請求項1～4の何れか1項に記載の電子写真感光体。



(式中Qはハロゲン原子、アルコキシ基又はアミノ基を表し、Aはアルキル基又はアリアル基を表し、有機官能基Yは ---BOOC(R')C=CH_2 、 ---BNHR'' 又は ---BNH_2 を表す。R'はアルキル基を表し、R''はアルキル基またはアリアル基を表し、Bはアルキレン基または ---O--- 、 ---NH--- 、 ---CO--- を含むアルキレン基を表す。p及びqは1以上の整数を表し、rは0以上の整数を表し、p+q+rは4である。)

【請求項7】 前記表面層がヒンダードアミン又はヒン

ダードフェノール化合物を含有することを特徴とする請求項1～6の何れか1項に記載の電子写真感光体。

【請求項8】 前記請求項1～7の何れか1項に記載の電子写真感光体を用い帯電、像露光、現像、転写、分離及びクリーニングを経て画像形成を行うことを特徴とする画像形成装置。

【請求項9】 前記請求項1～7の何れか1項に記載の電子写真感光体と、帯電器、像露光器、現像器、転写器、分離器及びクリーニング器の少なくとも1つとを組み合わせて造られていることを特徴とするプロセスカートリッジ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 電子写真感光体、該電子写真感光体を搭載したプロセスカートリッジ及び画像形成装置に関するものである。

【0002】

【従来の技術】 従来、電子写真感光体には無機光導電性物質を含有する無機感光体が用いられたが、近年無機感光体に代えて有機光導電性物質を含有する有機感光体が多く用いられるようになった。上記有機感光体(以下、感光体ともいう)では可視光から赤外光まで各種露光光源に対応した材料が開発し易いこと、環境汚染のない材料を選択できること、製造コストが安いこと等、無機感光体に比して優れた点が多いが、唯一の欠点は機械的強度が弱く、多数枚の複写やプリント時に感光層表面が摩耗、損傷して電子写真性能が劣化し易いことである。

【0003】 上記感光体の表面は、帯電器、現像器、転写器、分離器及びクリーニング器等により、電気的、機械的な外力が直接加えられるため摩耗損傷され易く、それらに対する耐久性の改良が要請されている。具体的には、摺擦による感光体表面の摩耗や傷の発生、異物の混入や紙詰まり処理時の衝撃等による膜剥がれ等に対する機械的耐久性の向上が要請されている。なかでも衝撃による傷や膜剥がれに対する耐久性については、無機感光体並みの強度が強く求められている。また、コロナ帯電時に発生するオゾンや活性酸素等による感光体表面の劣化等に対する耐久性も要請されている。

【0004】 上記のような感光体表面に要請される様々な特性を満たすため、これまで種々の改良方法が提案されている。即ち、感光体の表面にBPZポリカーボネートをバインダー樹脂として用いることにより、表面の摩耗特性、トナーフィルミング特性等が改善されることが報告されている。また、特開平6-118681号公報では感光体の表面の保護層にコロイダルシリカを含有する硬化性シリコン樹脂を用いることが報告されている。

【0005】 しかし、BPZポリカーボネートをバインダー樹脂として用いた感光体では、なお耐摩耗特性が不足しており、満足できる耐久性を有していない。一方、

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コロイダルシリカを含有する硬化性シリコン樹脂の表面層では耐摩耗特性は改善されるが、繰り返し使用時の電子写真特性が不十分であり、繰り返し使用時にカブリや画像ボケが発生し易く、耐久性が不十分であった。

【0006】このような欠点を改善する方法として、特開平9-124943号公報や、特開平9-190004号公報では正孔輸送性化合物を硬化性有機Si系高分子中に結合させた樹脂層を、表面層として有する感光体が提案されている。しかし、この樹脂層は高湿環境下でカブリや画像ボケが発生し易く十分な耐久性を有していない。また、このような硬化性有機Si化合物膜は、耐摩耗性は高いものの、外的な衝撃に対して傷が付き易いとか、感光層の膜剥れを生じ易いなどの欠点があり、感光層の膜強度や接着性が不十分であった。

【0007】

【発明が解決しようとする課題】本発明は上記実情に基づいて提案されたものであり、その目的とするところは、感光層表面の硬度が高く、耐摩耗性、耐傷性や接着性に優れており、繰り返して画像形成を行った場合、特に高温高湿下で繰り返して画像形成を行った場合でも感光体の電子写真性能の疲労劣化を生ずることがなく、カブリや画像ボケ等を生ぜず良好な画像が安定して得られる感光体、該感光体を用いたプロセスカートリッジ及び画像形成装置を提供することにある。

【0008】

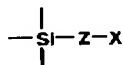
【課題を解決するための手段】本発明者等の鋭意検討の結果、上記の目的は、下記構成により達成されることを見いだした。

【0009】1. 導電性支持体上に、中間層を介して感光層を有する電子写真感光体において、該電子写真感光体の表面層が、下記一般式(1)で示される構造単位を含むシロキサン系硬化樹脂を含有する層であり、該中間層が有機金属化合物及び／又はシランカップリング剤を含有する層であることを特徴とする電子写真感光体。

【0010】

【化2】

一般式(1)



【0011】(式中、Xは電荷輸送能付与基であって、該付与基を構成する炭素原子を介して式中のZと結合する基であり、Zは隣接する結合原子(Si及びC)以外の2個以上の原子又は基である。)

2. 前記一般式(1)において、Xは電荷輸送能付与基であって、該付与基を構成する炭素原子を介して式中のZと結合する基であり、Zは酸素原子(O)、硫黄原子(S)又はNR基であり、Rは水素原子又は1価の有機基であることを特徴とする前記1に記載の電子写真感光体。

【0012】3. 前記中間層に含有される有機金属化合物が金属アルコキシド又は有機金属キレートであることを特徴とする前記1又は2に記載の電子写真感光体。

【0013】4. 前記中間層が有機金属キレート及びシランカップリング剤を含有する層であることを特徴とする前記1～3の何れかの1項に記載の電子写真感光体。

【0014】5. 前記中間層に含有される有機金属キレートが下記一般式(2)で示されることを特徴とする前記3又は4に記載の電子写真感光体。

【0015】一般式(2) $(\text{R}^1\text{O})_l-\text{M}-(\text{K})_m$
(式中、 R^1 はアルキル基であり、Mはジルコニウム、チタニウム又はアルミニウムを表し、キレート形成基Kはアセト酢酸エステル基又はβジケトン残基を表し、l、mは1以上の整数を表す。ただし、Mがジルコニウム又はチタニウムの場合、 $l+m$ は4であり、Mがアルミニウムの場合は $l+m$ は3である。) 6. 前記中間層に含有されるシランカップリング剤が、下記一般式

(3)で示されることを特徴とする前記1～4の何れかの1項に記載の電子写真感光体。

【0016】

一般式(3) $(\text{Q})_p-\text{Si}(\text{Y})_q-(\text{A})_r$
(式中Qはハロゲン原子、アルコキシ基又はアミノ基を表し、Aはアルキル基又はアリール基を表し、有機官能基Yは $-\text{BOOC}(\text{R}')\text{C}=\text{CH}_2$ 、 $-\text{BNHR}''$ 又は $-\text{BNH}_2$ を表す。 R' はアルキル基を表し、 R'' はアルキル基またはアリール基を表し、Bはアルキレン基または $-\text{O}-$ 、 $-\text{NH}-$ 、 $-\text{CO}-$ を含むアルキレン基を表す。p及びqは1以上の整数を表し、rは0以上の整数を表し、 $p+q+r$ は4である。)

7. 前記表面層がヒンダードアミン又はヒンダードフェノール化合物を含有することを特徴とする前記1～6の何れかの1項に記載の電子写真感光体。

【0017】8. 前記1～7の何れかの1項に記載の電子写真感光体を用い帯電、像露光、現像、転写、分離及びクリーニングを経て画像形成を行うことを特徴とする画像形成装置。

【0018】9. 前記1～7の何れかの1項に記載の電子写真感光体と、帯電器、像露光器、現像器、転写器、分離器及びクリーニング器の少なくとも1つとを組み合わせ造られていることを特徴とするプロセスカートリッジ。

【0019】本発明を詳細に説明する。

【0020】本発明の感光体は導電性支持体上に中間層を介して感光層を設けてなる感光体であって、該感光体の表面層が、構造中に前記一般式(1)で示される電荷輸送能付与基を有する構造単位を含むシロキサン系硬化樹脂からなる点に特徴があり、さらには該中間層が有機金属化合物、特に前記一般式(2)の有機金属化合物及び／又は前記一般式(3)のシランカップリング剤を含有する層からなる点に特徴があり、それによって本発

明に特有の高耐久性の感光体が得られる。

【0021】〈表面層の構成〉本発明の感光体の表面層は前記一般式(1)の電荷輸送能付与基Xを含むシロキサン系硬化樹脂から成る層であり、該シロキサン系硬化樹脂は、例えばシラノール基若しくはアルコキシ基等の加水分解性基を有するアルキル(ポリ)シロキサン系化合物及び／又は芳香族(ポリ)シロキサン系化合物と、前記一般式(1)の電荷輸送能付与基X及び隣接する結合原子(Si及びC)以外の2価以上の原子又は基Zを含む官能基を有する電荷輸送性化合物とを反応させ、必要により架橋剤又は硬化触媒を加えて硬化させて得られる。

【0022】なお、本発明でいう隣接する結合原子(Si及びC)以外の2価以上の原子又は基Zとは、好ましくは酸素原子(O)、硫黄原子(S)又はNR(Rは水素原子若しくは1価の有機基)等の2価以上の原子又は基であり、前記一般式(1)中の電荷輸送能付与基Xは、該Zを介して前記(ポリ)シロキサン系化合物のケイ素原子(Si)に結合され、架橋硬化されて目的のシロキサン系硬化樹脂が得られる。なおZがNRである場合、Rは水素原子又は1価の有機基であり、該有機基が電荷輸送能付与基Xであってもよい。

【0023】《電荷輸送能付与基Xを含む化合物》本発明でいうシロキサン系硬化樹脂に含まれる構造中において、前記一般式(1)の電荷輸送能付与基X及びZを含む官能基、例えばOH、SH、NH₂等の官能基を有する電荷輸送性化合物としては、大別して正孔輸送性(p型電荷輸送性)化合物と電子輸送性(n型電荷輸送性)化合物とがある。上記p型電荷輸送性化合物としては、例えばオキサゾール、オキサジアゾール、チアゾール、トリアゾール、イミダゾール、イミダゾロン、イミダゾリン、ビスイミダゾリン、スチリル、ヒドラゾン、ベンジジン、ピラゾリン、スチルベン化合物、アミン、オキサゾロン、ベンゾチアゾール、ベンズイミダゾール、キナゾリン、ベンゾフラン、アクリジン、フェナジン、アミノスチルベン、ポリ-N-ビニルカルバゾール、ポリ-1-ビニルピレン、ポリ-9-ビニルアントラセン又はその誘導体等が挙げられ、これらに限定されるものではない。

【0024】さらには、n型電荷輸送性化合物としては、例えば無水コハク酸、無水マレイン酸、無水フタル酸、無水ピロメリット酸、無水メリット酸、テトラシアノエチレン、テトラシアノキノジメタン、ニトロベンゼン、ジニトロベンゼン、トリニトロベンゼン、テトラニトロベンゼン、ニトロベンゾニトリル、ピクリルクロライド、キノンクロロイミド、クロラニル、ブロマニル、ベンゾキノン、ナフトキノン、ジフェノキノン、トロポキノン、アントラキノン、1-クロロアントラキノン、ジニトロアントラキノン、4-ニトロベンゾフェノン、4,4'-ジニトロベンゾフェノン、4-ニトロベンザ

ルマロンジニトリル、 α -シアノ- β -(p-シアノフェニル)-2-(p-クロロフェニル)エチレン、2,7-ジニトロフルオレン、2,4,7-トリニトロフルオレノン、2,4,5,7-テトラニトロフルオレノン、9-フルオレニリデンジシアノメチレンマロノニトリル、ポリニトロ-9-フルオロニリデンジシアノメチレンマロノジニトリル、ピクリン酸、o-ニトロ安息香酸、p-ニトロ安息香酸、3,5-ジニトロ安息香酸、ペンタフルオロ安息香酸、5-ニトロサリチル酸、3,5-ジニトロサリチル酸、フタル酸、メリット酸などの化合物と、及びこれらの誘導体が挙げられるが、これらに限定されるものではない。

【0025】なお、本発明の電荷輸送能付与基Xを有する構造単位の電荷輸送能に関する別の定義としては通常のTime-Of-Flight法などの公知の方法により電荷輸送に起因する検出電流値をもって表現することもできる。

【0026】また、本発明において電荷輸送能付与基Xを含む化合物としては少なくとも一つの前記Zを含む官能基を有するp型電荷輸送性化合物がより好ましく、該当する電荷輸送能付与基Xとは、該p型電荷輸送性化合物の前記Zを含む官能基を除いた残基であり、該残基のCが前記Zを介して(ポリ)シロキサン系化合物のSiに結合している基である。

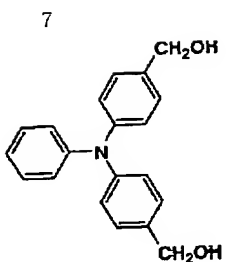
【0027】少なくとも一つの前記Zを含む官能基を有するp型電荷輸送性化合物のなかでも、特に好ましい本発明に有用なp型電荷輸送性化合物としては、例えば下記化合物を挙げることができる。

【0028】1. トリアリールアミン系化合物

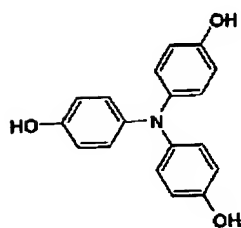
【0029】

【化3】

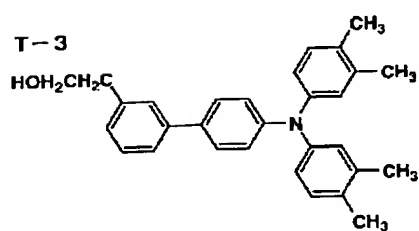
T-1



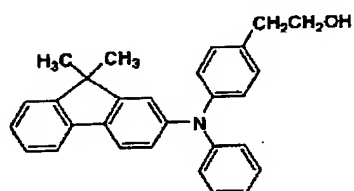
T-2



T-3



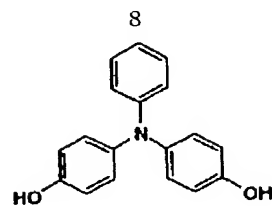
T-4



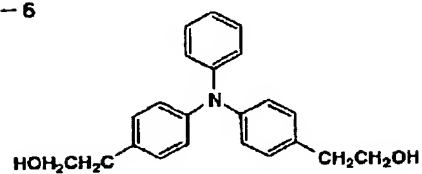
【0030】

【化4】

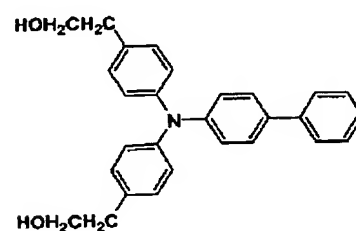
T-5



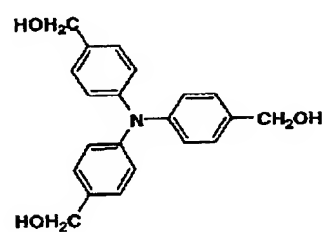
T-6



T-7



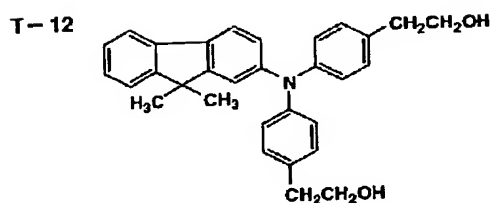
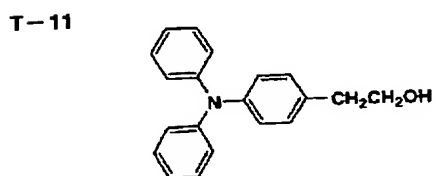
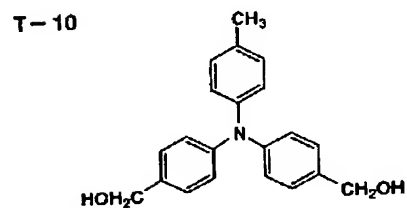
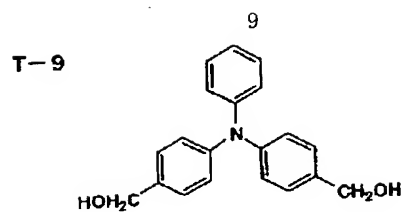
T-8



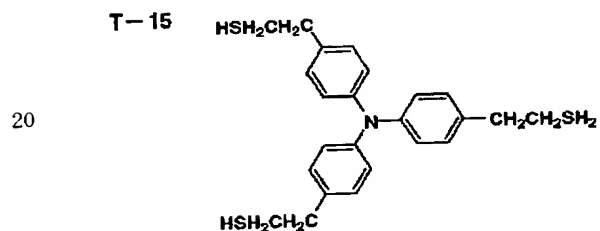
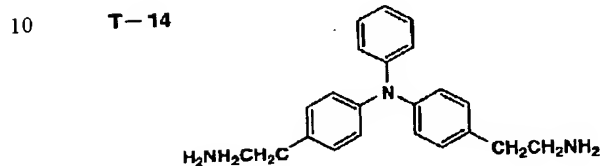
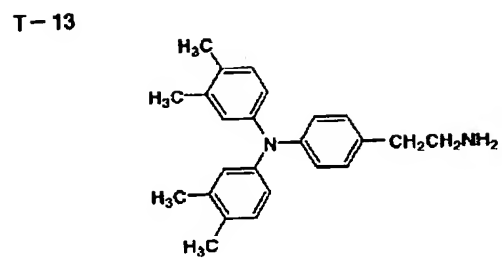
30

【0031】

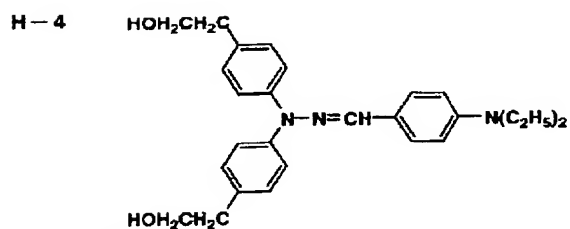
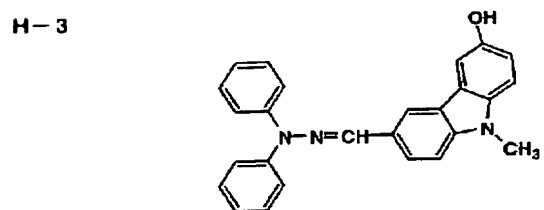
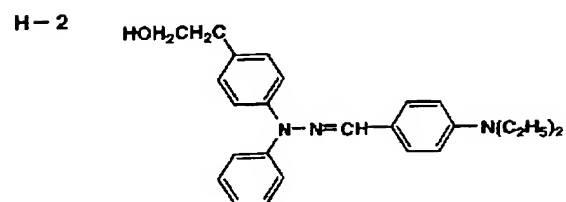
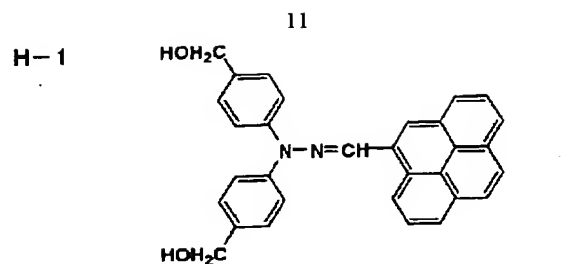
【化5】



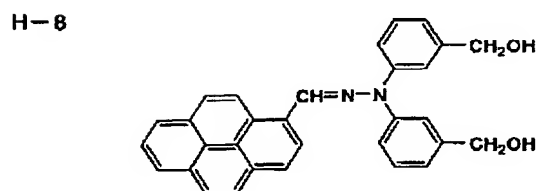
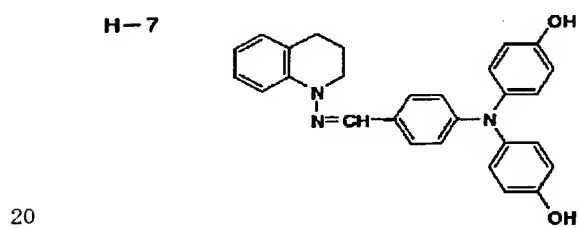
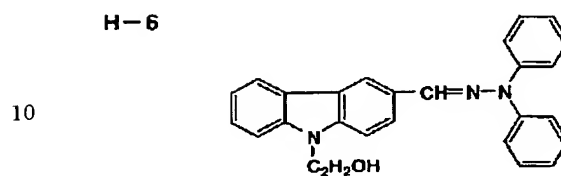
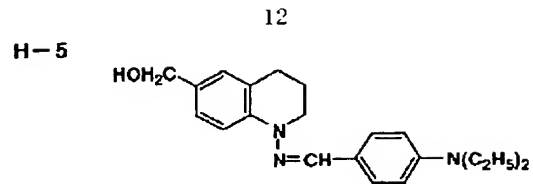
【0032】
【化6】



【0033】 2. ヒドラゾン系化合物
【0034】
【化7】



【0035】
【化8】

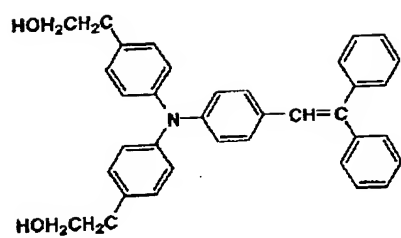


【0036】 3. スチルベン系化合物

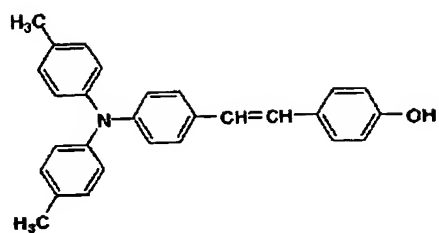
【0037】

30 【化9】

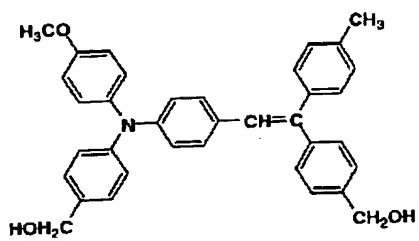
S-1



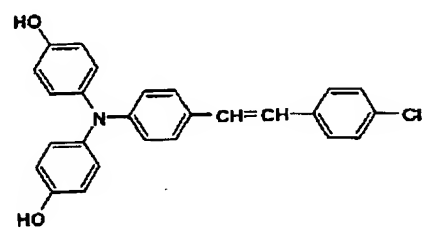
S-5



S-2

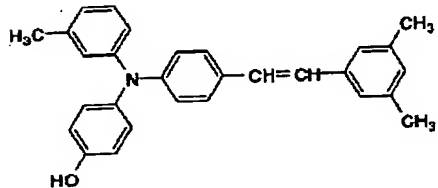


S-6



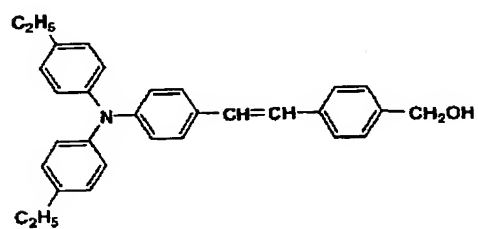
10

S-3

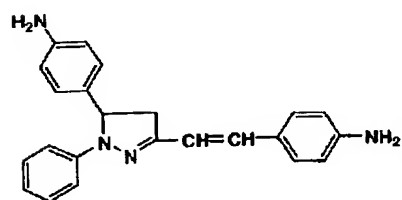


20

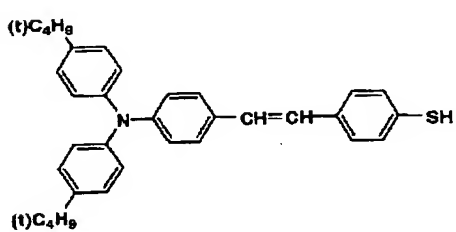
S-7



S-4



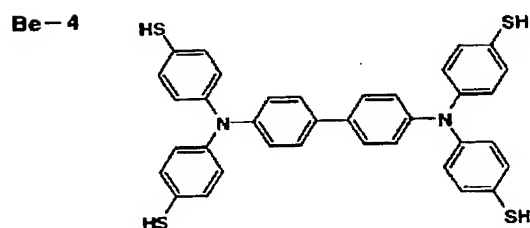
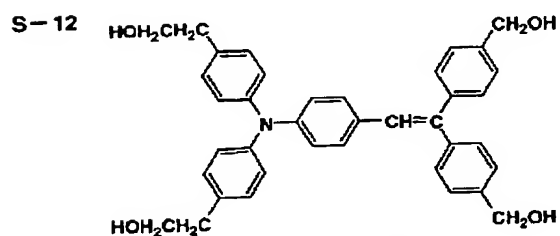
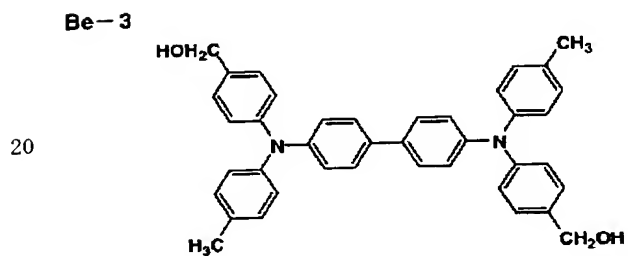
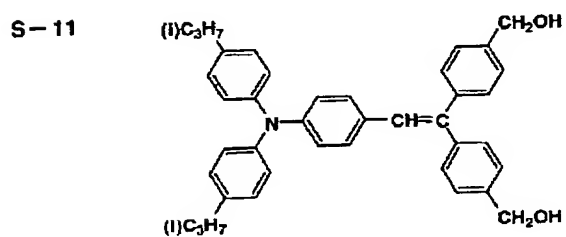
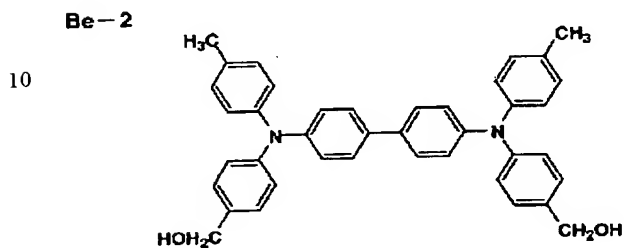
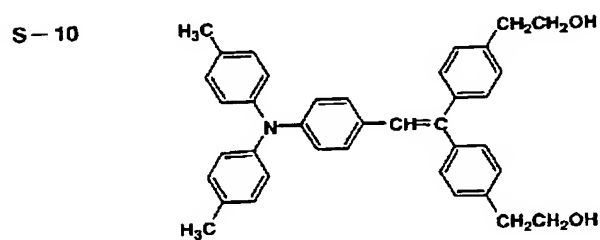
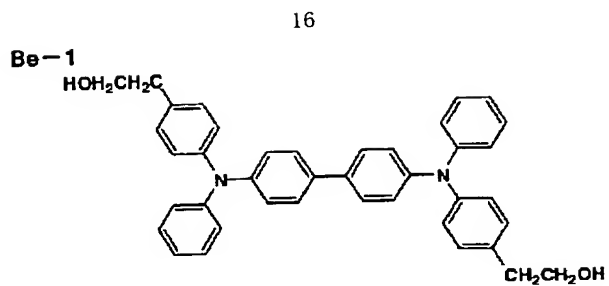
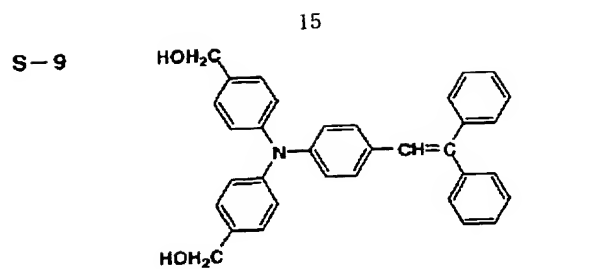
S-8



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【0039】
【化11】

【0038】
【化10】



【0040】4. ベンジジン系化合物

【0041】

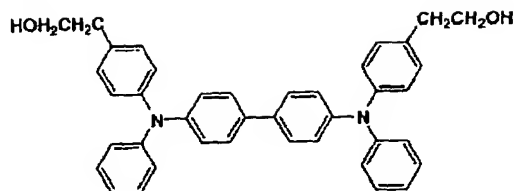
【化12】

【0042】

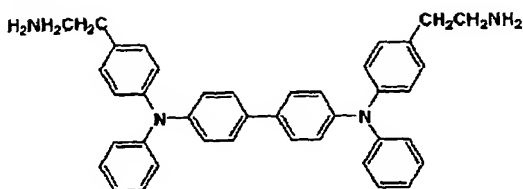
【化13】

17

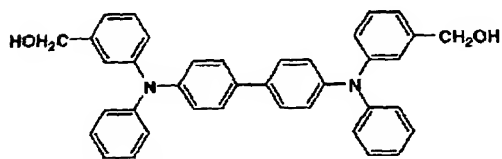
Be-5



Be-6



Be-7

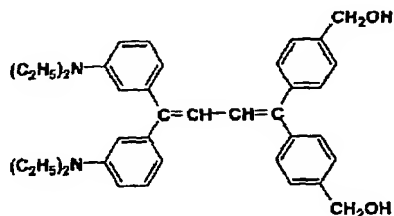


【0043】 5. プタジエン系化合物

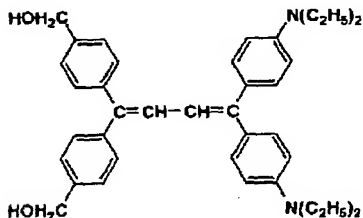
【0044】

【化14】

Bu-1



Bu-2



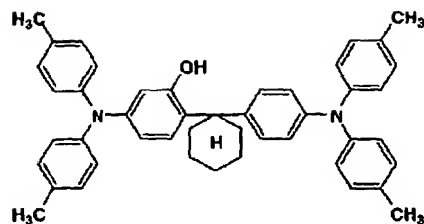
【0045】 6. その他の化合物

【0046】

【化15】

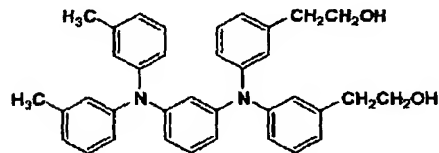
18

So-1

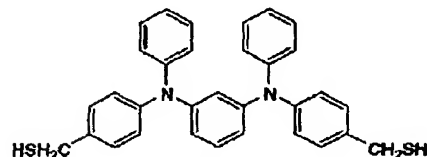


10

So-2



So-3



20

【0047】なお、上記一般式(1)のXは上記電荷輸送能の他、前記(ポリ)シロキサン系化合物とのクロスリンク基として存在してもよく、ペンダント基として接合していてもよく、上記p型電荷輸送性化合物が結合した(ポリ)シロキサン系化合物を含む塗布組成物の塗設後乾燥工程等において、必要により架橋剤、硬化触媒等の存在により該ポリシロキサン系化合物が互に架橋(クロスリンク)することにより、硬度の高い硬化樹脂層を形成することができる。

【0048】《シロキサン系硬化樹脂》本発明の表面層を形成するためのシロキサン系硬化樹脂としては予め構造単位内にシロキサン結合を有するモノマー、オリゴマー、ポリマー等の(ポリ)シロキサン系化合物に必要により硬化触媒や架橋剤を加えて新たな化学結合を形成させ三次元網目構造を形成したものである。例えばアルコキシシランの縮合反応やシラノールの縮合反応により三次元網目構造を形成させたものである。また、三次元網目構造にコロイダルシリカのような粒子を含ませても良い。

【0049】上記(ポリ)シロキサン系化合物の形成及び該(ポリ)シロキサン系化合物を互いにクロスリンクして架橋させ硬化樹脂層を形成するには、好ましくは官能基としては水酸基又は下記加水分解性基を有することが望ましい。

【0050】上記(ポリ)シロキサン系化合物における加水分解性基とは、具体的にはメトキシ基、エトキシ基、アセトキシ基、プロポキシ基、ブトキシ基、メトキシエトキシ基、ヘキサオキシ基等の炭素数が1~6のアルキル基を有するアルコキシ基が好ましい。

【0051】本発明におけるシロキサン系硬化性樹脂の原料として用いられる（ポリ）シロキサン系化合物は、一般にはSi原子に結合している水酸基又は加水分解性基の数nが1のとき、（ポリ）シロキサン系化合物の高分子化反応は抑制される。nが2、3又は4のときは高分子化反応が起こりやすく、特に3或いは4では高度に架橋反応を進めることが可能である。従って、これらをコントロールすることにより得られる塗布層の保存性や塗布層の硬度等を制御することができる。

【0052】本発明の表面層（保護層）であるシロキサン系硬化樹脂層中に含有される電荷輸送能付与基Xの含有割合は好ましくは1～70重量%の範囲が好ましく、1重量%未満では繰り返して画像形成の過程で感度低下やカブリの発生が大となり、良質の画像が得られなくなり、70重量%を越えると繰り返して画像形成の過程で電位低下により画像の濃度低下が大となり鮮明な画像が得られなくなる。

【0053】また本発明の表面層（保護層）の膜厚は通常0.01～10μmが好ましく、0.01μm未満では繰り返して画像形成の過程で感光層が摩耗損傷して感光体が疲労劣化し易く、10μmを越えると電子写真性能が低下しカブリが増大し易く良質の画像形成が困難になる。

【0054】《表面層に添加される酸化防止剤》また、本発明においては繰り返しての画像形成の過程での感光体の電子写真性能の疲労劣化を十分に防止するため、表面層に酸化防止剤を含有することが好ましく、特にヒンダードアミン、ヒンダードフェノール化合物、燐化合物又は硫黄化合物を含有することが好ましい。

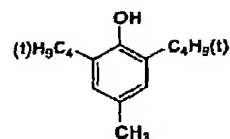
【0055】ヒンダードアミン化合物、ヒンダードフェノール化合物、燐化合物、硫黄化合物等本発明で好まし

く用いることができる化合物例を以下に示す。

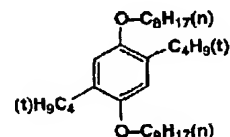
【0056】

【化16】

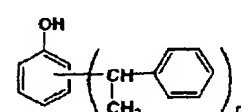
1-1



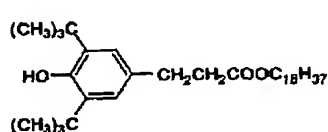
1-2



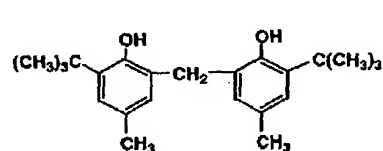
1-3



1-4



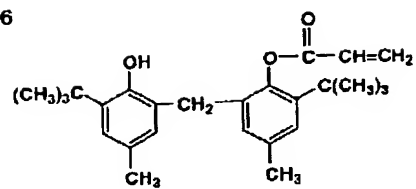
1-5



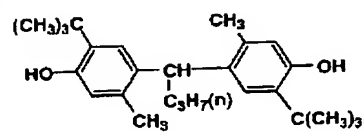
【0057】

【化17】

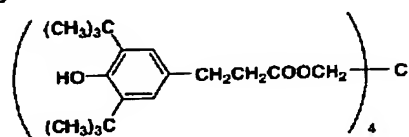
1-6



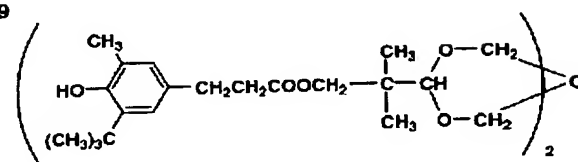
1-7



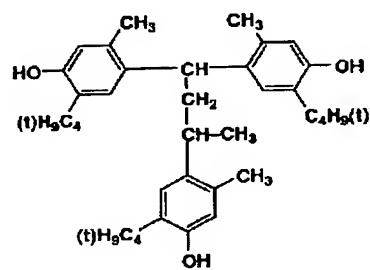
1-8



1-9



1-10

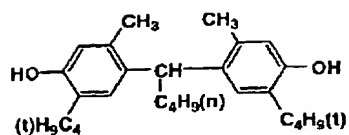


【0058】

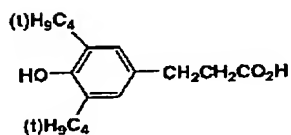
【化18】

23

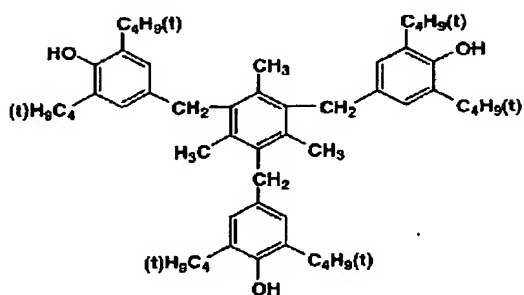
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1-12



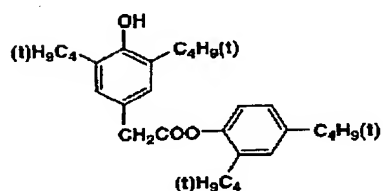
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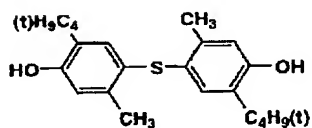
[0059]

[化19]

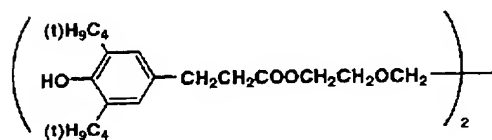
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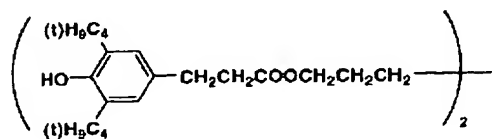
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1-16



1-17

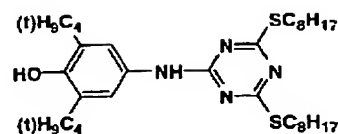


24

[0060]

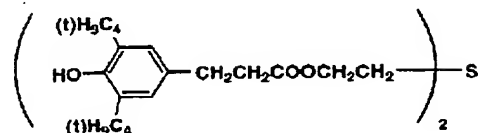
[化20]

1-18



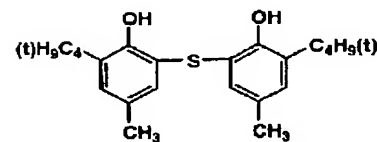
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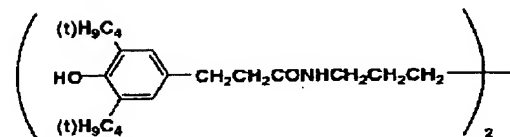


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1-21



[0061]

[化21]

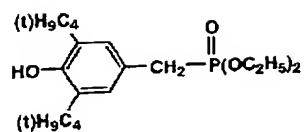
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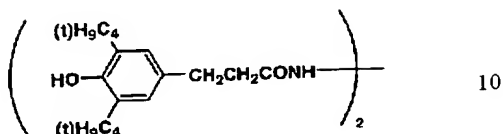
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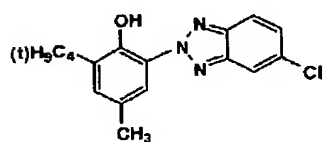
* [0062]

[化22]

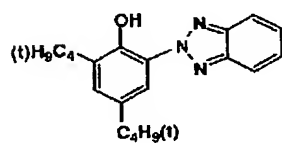
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1-24



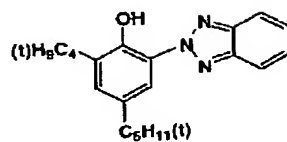
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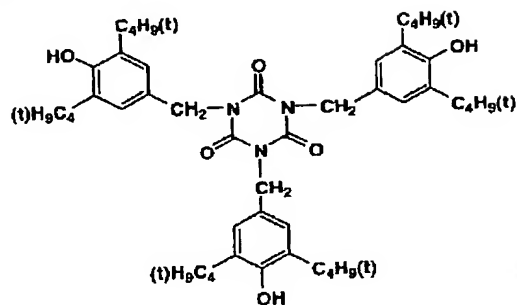
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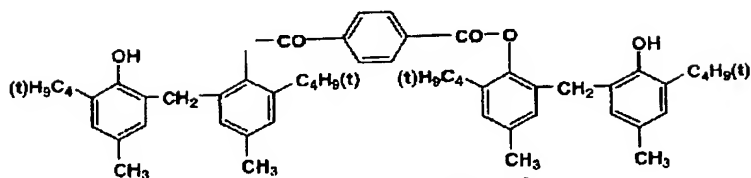
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1-27



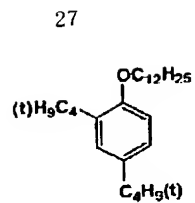
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[0063]

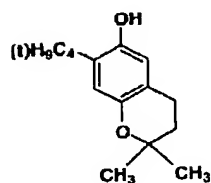
50 [化23]

1-29



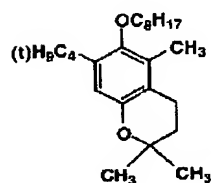
* [0 0 6 4]
【化 2 4】

1-30



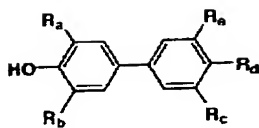
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1-31



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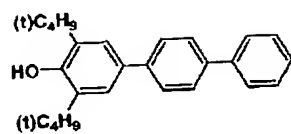
	R_a	R_b	R_c	R_d	R_e
1-32	Bu(t)	Bu(t)	H	H	H
1-33	Bu(t)	Bu(t)	H	CH ₃	H
1-34	Bu(t)	Bu(t)	Bu(t)	H	Bu(t)
1-35	Bu(t)	Bu(t)	Bu(t)	OH	Bu(t)
1-36	Bu(t)	H	H	H	H
1-37	C ₅ H ₁₁ (t)	C ₅ H ₁₁ (t)	H	H	H
1-38	C ₅ H ₁₁ (t)	H	H	H	H
1-39	Bu(t)	CH ₃	H	H	H

[0 0 6 5]

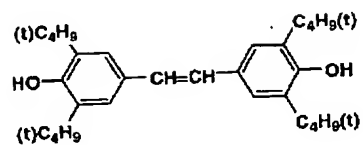
40 【化 2 5】

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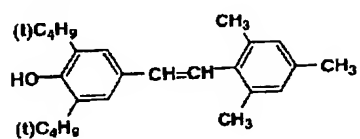
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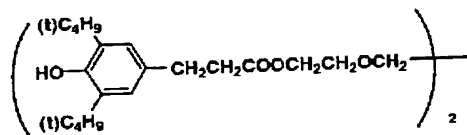
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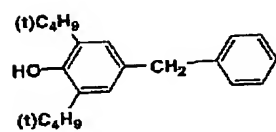
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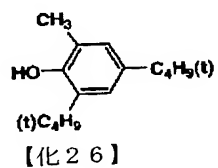
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1-44



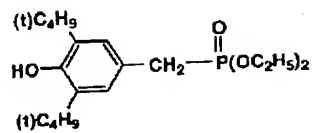
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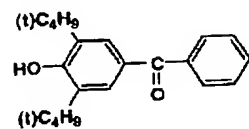
【0066】

31

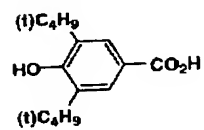
1-46



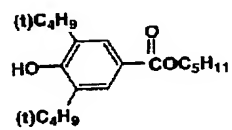
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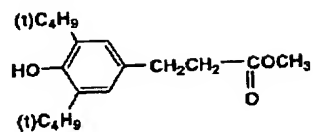
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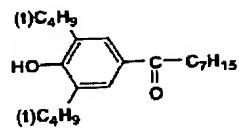
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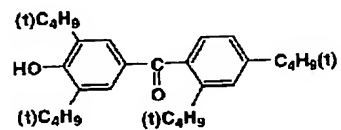
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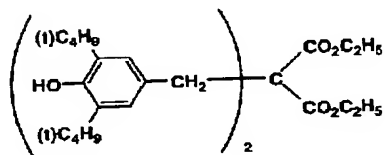
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1-51



1-53

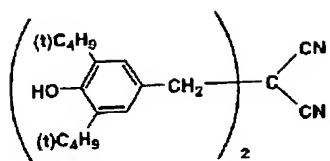


【化27】

【0067】

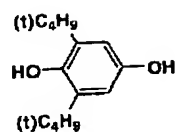
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1-54

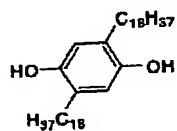


34

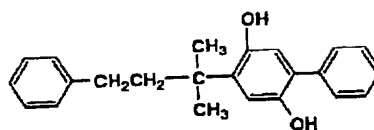
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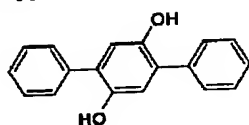
1-56



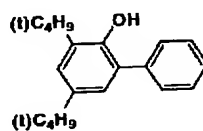
1-57



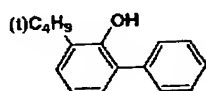
1-58



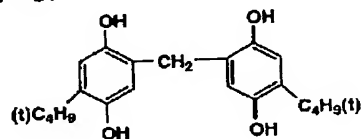
1-59



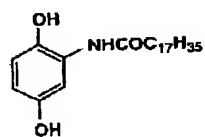
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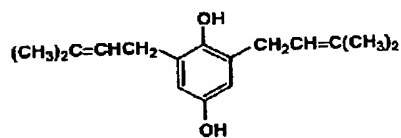
1-61



1-62



1-63

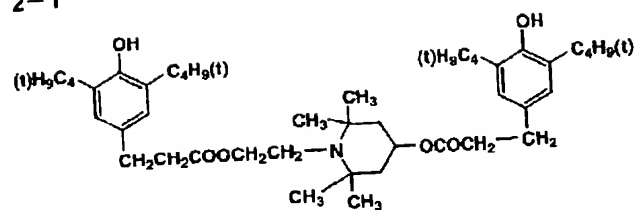


【化28】

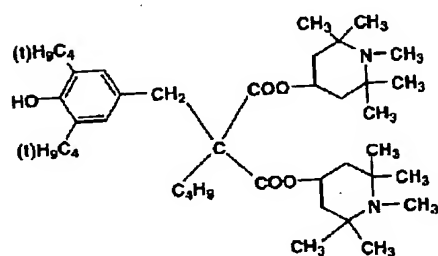
【0068】

35

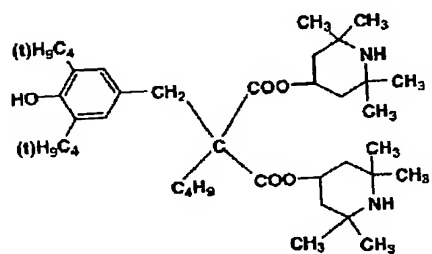
2-1



2-2



2-3

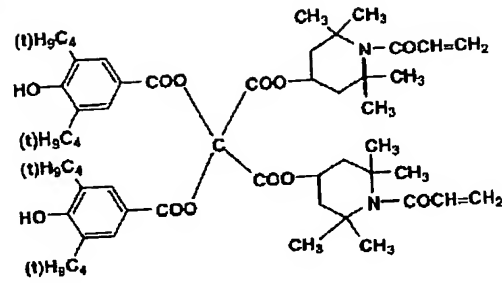


【化29】

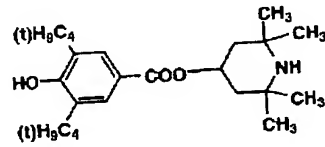
【0069】

37

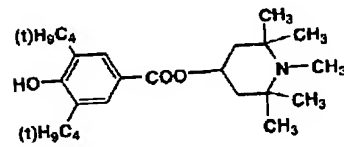
2-4



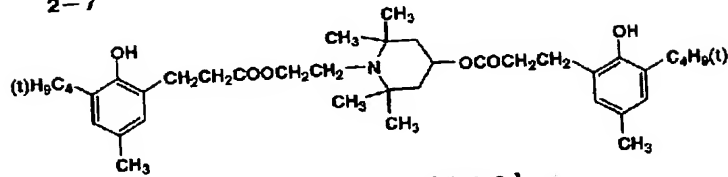
2-5



2-6



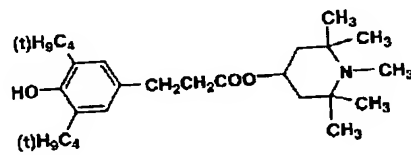
2-7



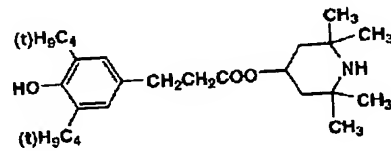
* * 【化30】

【0070】

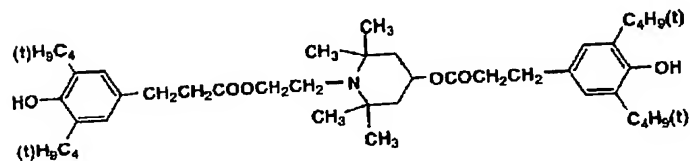
2-8



2-9



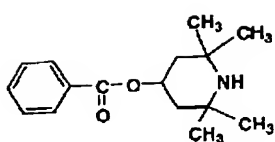
2-10



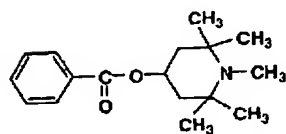
【0071】
【化31】

39

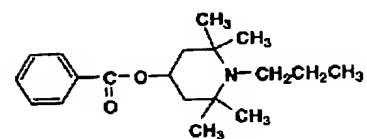
2-11



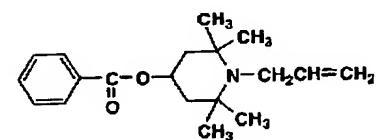
2-12



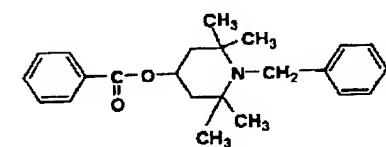
2-13



2-14



2-15

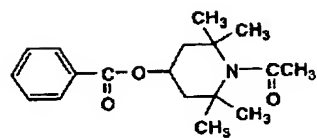


[0072]

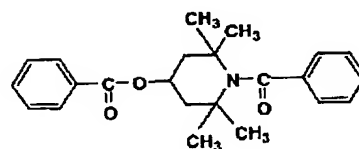
[化32]

40

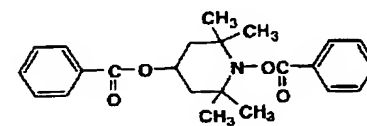
2-16



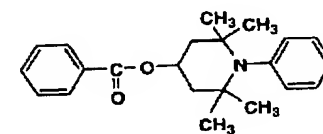
2-17



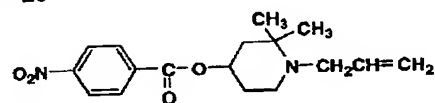
2-18



2-19



2-20



[0073]

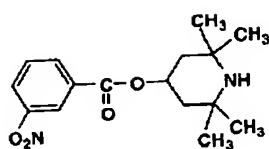
[化33]

10

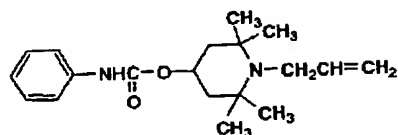
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41

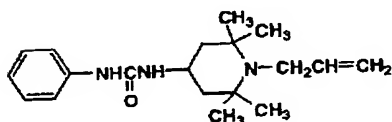
2-21



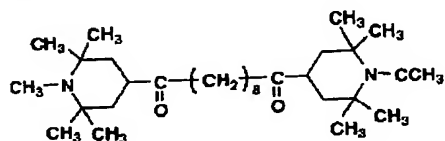
2-22



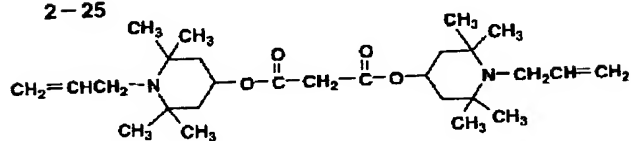
2-23



2-24



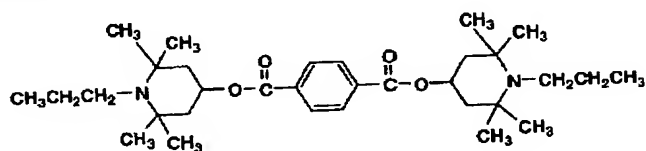
2-25



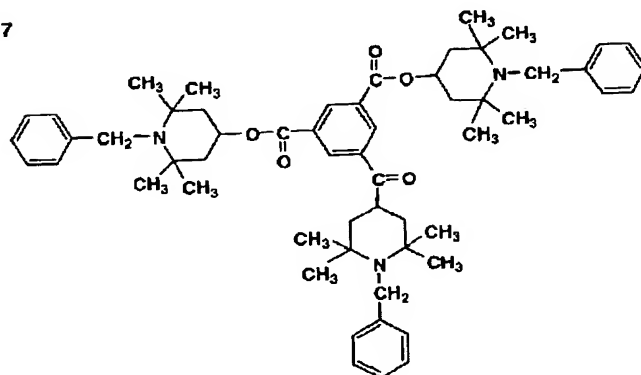
* * 【化34】

【0074】

2-26



2-27

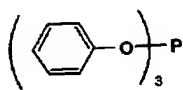


【化35】

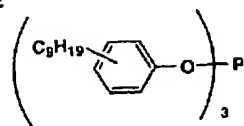
【0075】

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3-1



3-2



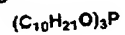
3-3



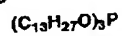
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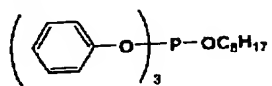
3-5



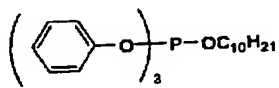
3-6



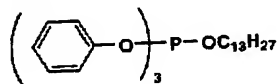
3-7



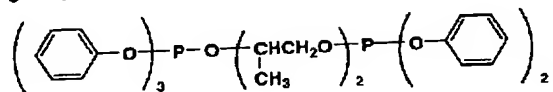
3-8



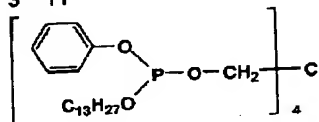
3-9



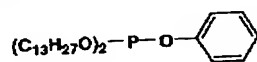
3-10



3-11



3-12



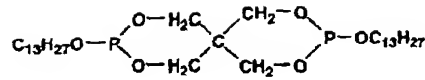
【化36】

【0076】

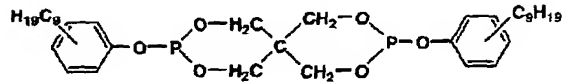
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46

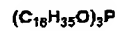
3-13



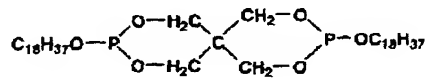
3-14



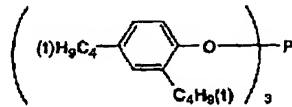
3-15



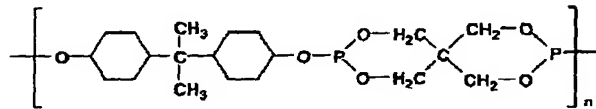
3-16



3-17



3-18



【0077】

* * 【化37】

4-1



4-2



4-3



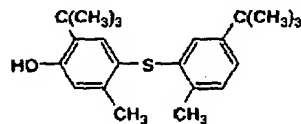
4-4



4-5



4-6



【0078】〈中間層の構成〉次に、本発明の感光体は導電性支持体上に感光層を設けて画像形成を行った場合の優れた画質や接着性を確保する上で該導電性支持体と感光層との間に有機金属化合物及び／又はシランカップリング剤を含有する中間層を設けることに特徴を有する。

【0079】《有機金属化合物、シランカップリング》本発明の感光体の中間層に含有される有機金属化合物と

しては、例えばジルコニウムテトラ-n-プロピレート、アルミニウムイソプロピレート、モノ-sec-ブトキシアルミニウム-i-プロピレート、アルミニウム-sec-ブチレート等のアルコキシド化合物であってもよく、また周期律表の第1a族、第1b族、第2a族、第3a族、第3b族、第4a族、第4b族、第5a族、第5b族及び第8族から選ばれる金属原子と、キレート剤としてアセト酢酸エステル、βジケトン、アセチ

ルアセトン、カテコール、エチレンジアミン、 α -フェニレンビスジメチルアニリン等により3、4、6、8分子の範囲で分子配位してなる有機金属キレート化合物であってもよい。

【0080】しかしながら、本発明の感光体の中間層には上記有機金属化合物として前記一般式(2)で示される有機金属キレート化合物を用い、かつ該有機金属キレート化合物と共に前記一般式(3)で示されるシランカップリング剤を組み合わせる含有するのが好ましい。

【0081】前記一般式(2)において R^1 は低級アルキル基であり、Mはジルコニウム、チタニウム又はアルミニウム等の金属原子を表し、キレート形成基Kはアセト酢酸エステル基又は β ジケトン残基を表し、l、mは1以上の整数を表す。ただし、Mがジルコニウム又はチタニウムの場合、 $l+m$ は4であり、Mがアルミニウムの場合は $l+m$ は3である。

【0082】前記一般式(2)で表される有機金属キレート化合物の具体的化合物例としては、例えばジイソプロポキシチタニウム(メチルアセトアセート)イソブトキシチタニウムトリ(メチルアセトアセート)トリブトキシチタニウムアセチルアセトネートジイソプロポキシアルミニウム(メチルアセトアセトネート)ジブトキシチタニウムビス(エチルアセトアセトネート)イソブトキシアルミニウム(アセチルアセトネート)等を挙げることができる。

【0083】次に前記一般式(3)で示されるシランカップリング剤において、Qはハロゲン原子、低級アルコキシ基又は置換基を有してもよいアミノ基を表し、Aは低級アルキル基又はフェニル基若しくはナフチル基等のアリール基を表し、有機官能基Yは $-BOOC(R')$ $C=CH_2$ 、 $-BNHR''$ 又は $-BNH_2$ を表す。 R' は低級アルキル基を表し、 R'' は低級アルキル基またはフェニル若しくはナフチル基等のアリール基を表し、Bは低級アルキレン基または $-O-$ 、 $-NH-$ 、 $-CO-$ を含む低級アルキレン基を表す。p及びqは1以上の整数を表し、rは0以上の整数を表し、 $p+q+r$ は4である。

【0084】前記一般式(3)で表されるシランカップリング剤の具体的化合物例としては、例えば γ -メタクリロキシプロピルトリメトキシシラン γ -メタクリロキシプロピルトリエトキシシラン γ -メタクリロキシプロピルメチルジメトキシシラン等をあげることができる。

【0085】本発明において、中間層の膜厚は0.1~10 μm が好ましく、特に0.1~5 μm が好ましい。

【0086】《感光体の層構成》本発明の感光体の層構成

成は導電性支持体に中間層を介して電荷発生物質(CGM)を含有する電荷発生層(CGL)、電荷輸送物質(CTM)を含有する電荷輸送層(CTL)及び表面層(保護層として)をこの順に設けた構成でも良く、また中間層を介してCGMを含有するCGL及び表面層(CTLとして)をこの順に設けた構成でも良く、また中間層を介してCGMを含有する表面層(感光層として)を設けた構成でも良く、さらにまた中間層を介してCGM及びCTMを共に含有する感光層及び表面層(保護層として)をこの順に設けた構成であっても良い。

【0087】しかしながら本発明においては、実用性の点から導電性支持体に中間層を介してCGMを含有するCGL、CTMを含有するCTL及び表面層(保護層として)をこの順に設けた構成が特に重要である。

【0088】本発明の上記表面層は、上記のようにCTLを兼ねる場合があってもよいが、好ましくは、CTL若しくはCGL或いは単層型の感光層の上に、保護層としてこれらとは別層として設けるのがよい。この場合、上記感光層と本発明の表面層との間に接着層を設けるのが更に好ましい。

【0089】《感光層に含有されるCGM、CTM》本発明の感光層に含有されるCGMとしては、例えばフタロシアニン顔料、多環キノロン顔料、アゾ顔料、ペリレン顔料、インジゴ顔料、キナクリドン顔料、アズレニウム顔料、スクワリリウム染料、シアニン染料、ピリリウム染料、チオピリリウム染料、キサンテン色素、トリフェニルメタン色素、スチリル色素等が挙げられ、これらのCGMは単独で又は適当なバインダー樹脂と共に層形成が行われる。

【0090】前記感光層に含有されるCTMとしては、例えばオキサゾール誘導体、オキサジアゾール誘導体、チアゾール誘導体、チアジアゾール誘導体、トリアゾール誘導体、イミダゾール誘導体、イミダゾロン誘導体、イミダゾリン誘導体、ビスイミダゾリジン誘導体、スチリル化合物、ヒドラゾン化合物、ベンジジン化合物、ピラゾリン誘導体、スチルベン化合物、アミン誘導体、オキサゾロン誘導体、ベンゾチアゾール誘導体、ベンズイミダゾール誘導体、キナゾリン誘導体、ベンゾフラン誘導体、アクリジン誘導体、フェナジン誘導体、アミノスチルベン誘導体、ポリ-N-ビニルカルバゾール、ポリ-1-ビニルピレン、ポリ-9-ビニルアントラセン等が挙げられこれらのCTMは通常バインダー樹脂と共に層形成が行われる。

【0091】《感光層のバインダー樹脂》単層構成の感光層、及び積層構成の場合のCGL、CTLに含有されるバインダー樹脂としては、ポリカーボネート樹脂、ポリエステル樹脂、ポリスチレン樹脂、メタクリル樹脂、アクリル樹脂、ポリ塩化ビニル樹脂、ポリ塩化ビニリデン樹脂、ポリビニルブチラール樹脂、ポリビニルアセテート樹脂、スチレン-ブタジエン樹脂、塩化ビニリデン

ーアクリロニトリル共重合体樹脂、塩化ビニル無水マレイン酸共重合体樹脂、ウレタン樹脂、シリコン樹脂、エポキシ樹脂、シリコンーアルキッド樹脂、フェノール樹脂、ポリシラン樹脂、ポリビニルカルバゾール等が挙げられる。

【0092】本発明においてCGL中のCGMとバインダー樹脂との割合は重量比で1:5~5:1が好ましい。またCGLの膜厚は5 μ m以下が好ましく、特に0.05~2 μ mが好ましい。

【0093】又、CTLは前記のCTMとバインダー樹脂を適当な溶剤に溶解し、その溶液を塗布乾燥することによって形成される。CTMとバインダー樹脂との混合割合は重量比で3:1~1:3が好ましい。

【0094】また、CTLの膜厚は5~50 μ m、特に10~40 μ mが好ましく、CTLが複数設けられている場合は、該複数のCTLの上層の膜厚は10 μ m以下が好ましく、かつ、該複数のCTLの上層の下に設けられた全てのCTLの膜厚より小さいことが好ましい。

【0095】《感光層用の溶剤、分散剤》本発明の感光体の感光層、中間層、保護層等に用いられる溶剤又は分散剤としては、n-ブチルアミン、ジエチルアミン、エチレンジアミン、イソプロパノールアミン、トリエタノールアミン、トリエチレンジアミン、N,N-ジメチルホルムアミド、アセトン、メチルエチルケトン、メチルイソプロピルケトン、シクロヘキサノン、ベンゼン、トルエン、キシレン、クロロホルム、ジクロロメタン、1,2-ジクロロエタン、1,2-ジクロロプロパン、1,1,2-トリクロロエタン、1,1,1-トリクロロエタン、トリクロロエチレン、テトラクロロエタン、テトラヒドロフラン、ジオキソラン、ジオキサン、メタノール、エタノール、ブタノール、イソプロパノール、酢酸エチル、酢酸ブチル、ジメチルスルホキシド、メチルセロソルブ等が挙げられる。本発明はこれらに限定されるものではないが、ジクロロメタン、1,2-ジクロロエタン、メチルエチルケトン等が好ましく用いられる。また、これらの溶媒は単独或いは2種以上の混合溶剤として用いることもできる。

【0096】《導電性支持体》次に本発明の電子写真感光体の導電性支持体としては、

- 1) アルミニウム板、ステンレス板などの金属板、
- 2) 紙或いはプラスチックフィルムなどの支持体上に、アルミニウム、パラジウム、金などの金属薄層をラミネート若しくは蒸着によって設けたもの、
- 3) 紙或いはプラスチックフィルムなどの支持体上に、導電性ポリマー、酸化インジウム、酸化錫などの導電性化合物の層を塗布若しくは蒸着によって設けたもの等が挙げられる。

【0097】本発明で用いられる導電性支持体の材料としては、主としてアルミニウム、銅、真鍮、スチール、ステンレス等の金属材料、その他プラスチック材料をベ

ルト状またはドラム状に成形加工したものが用いられる。中でもコスト及び加工性に優れたアルミニウムが好ましく用いられ、通常押出成型または引拔成型された薄肉円筒状のアルミニウム素管が多く用いられる。

【0098】また、支持体の形状はドラム状でもシート状でもベルト状でもよく、適用する電子写真装置に最適した形状であることが好ましい。

【0099】《塗布加工方法》次に本発明の電子写真感光体を製造するための塗布加工方法としては、浸漬塗布、スプレー塗布、円形量規制型塗布等の塗布加工法が用いられるが、感光層の表面層側の塗布加工は下層の膜を極力溶解させないため、又、均一塗布加工を達成するためスプレー塗布又は円形量規制型(円形スライドホッパ型がその代表例)塗布等の塗布加工方法を用いるのが好ましい。なお前記スプレー塗布については例えば特開平3-90250号及び特開平3-269238号公報に詳細に記載され、前記円形量規制型塗布については例えば特開昭58-189061号公報に詳細に記載されている。

【0100】本発明においては、更に、支持体と中間層との間に支持体の表面欠陥を補うための被覆を施すことや、特に画像入力がレーザー光の場合には問題となる干渉縞の発生を防止することなどを目的とした導電層を設けることができる。この導電層は、カーボンブラック、金属粒子又は金属酸化物粒子等の導電性粉体を適当なバインダー樹脂中に分散した溶液を塗布乾燥して形成することができる。導電層の膜厚は5~40 μ mが好ましく、特に10~30 μ mが好ましい。

【0101】《画像形成装置、プロセスカートリッジ》本発明の感光体は、複写機、レーザープリンター、LEDプリンター、液晶シャッター式プリンター等の電子写真方式の画像形成装置一般に適用し得るものであるが、更には電子写真技術を応用したディスプレイ、記録、軽印刷、製版、ファクシミリ等の画像形成装置にも広く適用し得るものである。

【0102】図1に本発明の感光体を有する画像形成装置の断面図を示す。

【0103】図1において10は感光体ドラムで、感光層をドラム上に塗布し、その上に本発明の表面層(保護層)を塗設した感光体で、接地されて時計方向に駆動回転される。12はスコトロンの帯電器で、感光体ドラム10周面に対し一様な帯電をコロナ放電によって与えられる。この帯電器12による帯電に先だって、前の画像形成での感光体の履歴をなくすために発光ダイオード(LED)等を用いた露光部11による露光を行って感光体周面の除電をしてもよい。

【0104】感光体への一様な帯電ののち像露光器13により画像信号に基づいた像露光が行われる。この図の像露光器13は図示しないレーザー又はLEDを露光光源とする。回転するポリゴンミラー131、f θ レンズ等

を経て反射ミラー132により光路を曲げられた光により感光体ドラム上の走査がなされ、静電潜像が形成される。

【0105】その静電潜像は次いで現像器14で現像される。感光体ドラム10周縁にはイエロー(Y)、マゼンタ(M)、シアン(C)、黒色(K)等のトナーとキャリアとから成る現像剤をそれぞれ内蔵した現像器14が設けられていて、先ず1色目の現像がマグネットを内蔵し現像剤を保持して回転する現像スリーブ141によって行われる。現像剤は、例えばフェライトをコアとしてそのまわりに絶縁性樹脂をコーティングしたキャリアと、ポリエステルを主材料として色に応じた顔料と荷電制御剤、シリカ、酸化チタン等を加えたトナーとからなるもので、現像剤は図示していない層形成手段によって現像スリーブ141上に100~600 μ mの層厚に規制されて現像域へと搬送され、現像が行われる。この時通常は感光体ドラム10と現像スリーブ141の間に直流及び/又は交流バイアス電圧をかけて現像が行われる。

【0106】カラー画像形成に於いては、1色目の顕像化が終った後2色目の画像形成行程にはいり、再びスコロトン帯電器12による一様帯電が行われ、2色目の潜像が像露光器13によって形成される。3色目、4色目についても2色目と同様の画像形成行程が行われ、感光体ドラム10周面上には4色の顕像が形成される。一方モノクロの電子写真方式の画像形成装置では現像器14は黒トナー1種で構成され、1回の現像で画像を形成することができる。

【0107】記録紙Pは画像形成後、転写のタイミングの整った時点で給紙ローラ17の回転作動により転写域へと給紙される。

【0108】転写域においては転写のタイミングに同期してドラム状の感光体10の周面に転写ローラ(転写器)18が圧接され、給紙された記録紙Pを挟着して多色像が一括して転写される。

【0109】次いで記録紙Pは転写ローラとほぼ同時に圧接状態とされた分離器19によって除電がなされ、ドラム状の感光体10の周面により分離して定着装置20に搬送され、熱ローラ201と圧着ローラ202の加熱、加圧によってトナーを溶着したのち排紙ローラ21*40

実施例1

〈実施例1の感光体の作製〉

《中間層》

ジルコニウムキレート化合物「ZC-540」(松本製薬社製)

	200g
シランカップリング剤「KBM-903」(信越化学社製)	100g
メタノール	700ml
エタノール	300ml

ドラム状のアルミニウム支持体上に上記組成物を浸漬塗布し、150℃30分間乾燥し、厚さ1.0 μ mの中間

*を介して装置外部に排出される。なお前記の転写ローラ18及び分離器19は記録紙Pの通過後ドラム状の感光体10の周面より退避離間して次なるトナー像の形成に備える。

【0110】一方記録紙Pを分離した後のドラム状の感光体10は、クリーニング器22のブレード221の圧接により残留トナーを除去・清掃し、再び露光部11による除電と帯電器12による帯電を受けて次なる画像形成のプロセスに入る。なお感光体上にカラー画像を重ね合わせて形成する場合には、前記のブレード221は感光体面のクリーニング後直ちに移動してドラム状の感光体10の周面より退避する。

【0111】なお、30は感光体、帯電器、転写器・分離器及びクリーニング器を一体化されている着脱可能なプロセスカートリッジである。

【0112】電子写真方式の画像形成装置としては、上述のドラム状の感光体と、現像器、クリーニング器等の構成要素をプロセスカートリッジとして一体に結合して構成し、このユニットを装置本体に対して着脱自在に構成しても良い。又、帯電器、像露光器、現像器、転写又は分離器、及びクリーニング器の少なくとも1つを感光体とともに一体に支持してプロセスカートリッジを形成し、装置本体に着脱自在の単一ユニットとし、装置本体のレールなどの案内手段を用いて着脱自在の構成としても良い。

【0113】像露光は、画像形成装置を複写機やプリンターとして使用する場合には、原稿からの反射光や透過光を感光体に照射すること、或いはセンサーで原稿を読み取り信号化し、この信号に従ってレーザービームの走査、LEDアレイの駆動、又は液晶シャッターアレイの駆動を行い感光体に光を照射することなどにより行われる。

【0114】なお、ファクシミリのプリンターとして使用する場合には、像露光器13は受信データをプリントするための露光を行うことになる。

【0115】

【実施例】以下、実施例を挙げて本発明を詳細に説明するが、本発明の態様はこれに限定されない。

【0116】

層を形成した。

【0117】

53

《CGL》

下記構造のCGM(C1)

シリコン樹脂「KR5240」(信越化学社製)の15%キシレンー
ブタノール溶液 700g
メチルエチルケトン 2000ml

上記組成物を混合し、サンドミルを用いて10時間分散し、CGL塗布液を調製した。この塗布液を前記中間層の上に浸漬塗布法で塗布し、膜厚0.2μmのCGLを*

*形成した。

【0118】

《CTL》

下記構造のCTM(D1)

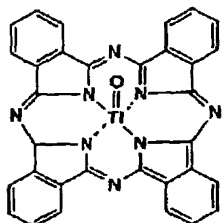
ビスフェノールZ型ポリカーボネート「ユーピロンZ300」(三菱瓦斯化学社製) 200g
1,2-ジクロロエタン 300g
2000ml

を混合し、溶解して、CTL塗布液を調製した。この塗布液を前記CGLの上に浸漬塗布法で塗布し、膜厚20μmのCTLを形成した。

【0119】

【化38】

CGM(C1)

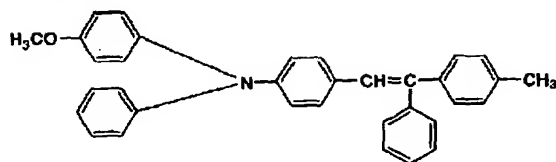


【0120】但し、CuKαの特性X線を用いたX線回折図において、ブラッグの角(2θ±0.2°)が27.3°に最大ピークを有し、その他9.5°、11.6°、15.0°及び24.1°に少なくとも1つのピークを有するオキシチタニウムフタロシアニンである。

【0121】

【化39】

CTM(D1)



【0122】この上に市販のプライマー「PC-7」(信越化学社製)をトルエンで2倍に希釈し、塗布後100℃で30分間乾燥させ、乾燥膜厚0.3μmの接着層を形成した。

【0123】この上にメチルシロキサン単位80モル%、メチルフェニルシロキサン単位20モル%から成るポリシロキサン樹脂(1重量%のシラノール基を含む)10重量部に市販の脱水剤「モレキュラーシーブ4A」(和光純薬製造(株)製)を添加し、15時間静置し脱水処理した。この樹脂をトルエン10重量部に溶解

54

60g

700g

2000ml

し、これにメチルトリメトキシシラン5重量部、ジブチル錫アセテート0.2重量部を加え均一な溶液にした。

【0124】これにトリアリールアミン型電荷輸送性化合物(例示化合物T-1)6重量部を加えて混合し、この溶液を乾燥膜厚1μmの表面層(保護層)として塗布して、120℃で1時間の乾燥を行い実施例1の感光体を作製した。

【0125】実施例2

〈実施例2の感光体の作製〉実施例1の感光体の保護層中のトリアリールアミン型電荷輸送性化合物(例示化合物T-1)に代えてトリアリールアミン型電荷輸送性化合物(例示化合物T-14)を用いた他は同様にして実施例2の感光体を作製した。

【0126】実施例3

〈実施例3の感光体の作製〉実施例1の感光体の保護層中のトリアリールアミン型電荷輸送性化合物(例示化合物T-1)に代えてトリアリールアミン型電荷輸送性化合物(例示化合物T-15)を用いた他は同様にして実施例3の感光体を作製した。

【0127】実施例1~3の感光体の評価は該感光体をKonica7050(コニカ社製デジタル複写機)に搭載し、初期帯電電位-650Vに設定して画像形成テストを行った。即ち、20℃60%RH、30℃80%RH環境下において、A4紙を用い初期及び10万枚の画像評価を行ったところ、どちらの環境条件でも初期及び10万枚ともカブリも発生せず、且つ黒ベタ部の濃度は反射濃度で1.2以上の濃度が得られ、均一性の優れた画像が得られた。又、10万枚終了時点の感光体の摩耗量も0.1μm以下と非常に少なかった。更に感光体表面のキズが殆ど見られず、ハーフトーン画像上にもスリ傷による画像欠陥は見られなかった。また、感光層の剥離も見られなかった。

【0128】比較例1

〈比較例1の感光体の作製〉実施例1の感光体中の保護層中のトリアリールアミン型電荷輸送性化合物(例示化合物T-1)を4-(2-(トリエトキシシリル)エチル)トリフェニルアミンに代えた他は同様にして比較例

1の感光体を作製した。

【0129】比較例1の感光体の評価を前記実施例1の感光体の場合と同様に行った結果、20℃60%RHの環境では良好な画像が得られたが、30℃80%RHでは7万枚の画像でカブリが発生し、且つ画像の一部で画像ボケが発生した。

*

シランカップリング剤「KBM-903」（信越化学社製）	300g
水	30ml
エタノール	1000ml

また、実施例1の感光体の保護層中のポリシロキサン樹脂を、メチルシロキサン単位80モル%、ジメチルシロキサン単位20モル%から成るポリシロキサン樹脂（2重量%のシラノール基を含む）に代えた他は同様にして実施例4の感光体を作製した。

※

ポリアミド樹脂「CM-8000」（東レ社製）	15g
2-プロパノール	150ml
メタノール	850ml

比較例2の感光体の評価を実施例1の感光体の場合と同様に行った結果、20℃60%RHの環境では良好な画像が得られたが、30℃80%RHでは6万枚の画像で黒ベタ部の反射濃度が1.0まで低下し、且つ画像の一部で画像ボケが発生した。また、10万枚終了後の感光層の一部に感光層の剥離が見られた。

【0134】実施例5

〈実施例5の感光体の作製〉実施例1の感光体の保護層のポリシロキサン樹脂を、メチルシロキサン単位30モル%、エチルシロキサン単位40モル%、ジメチルシロキサン単位20モル%、ジエチルシロキサン単位10モル%から成るポリシロキサン樹脂（2重量%のシラノール基を含む）に代えた他は同様にして実施例5の感光体

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【0135】実施例6

〈実施例6の感光体の作製〉実施例1の感光体の保護層のポリシロキサン樹脂を、メチルシロキサン単位30モル%、フェニルシロキサン単位30モル%、ジメチルシロキサン単位20モル%、ジエチルシロキサン単位20モル%から成るポリシロキサン樹脂（2重量%のシラノール基を含む）に代えた他は同様にして実施例6の感光体を作製した。

【0136】実施例7

〈実施例7の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、ヒドラゾン型電荷輸送性化合物（例示化合物H-1）に代えた他は同様にして実施例7の感光体を作製した。

【0137】実施例8

〈実施例8の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、ヒドラゾン型電荷輸送性化合物（例示化合物H-5）に代えた他は同様にして実施例8の感光体を

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*【0130】実施例4

〈実施例4の感光体の作製〉実施例1の感光体の中間層を下記の材料に代えた他は同様にして実施例4の感光体を作製した。

【0131】

※【0132】比較例2

〈比較例2の感光体の作製〉実施例1の感光体の中間層を下記材料に代えた他は同様にして、比較例2の感光体を作製した。

【0133】

作製した。

【0138】実施例9

〈実施例9の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、スチルベン型電荷輸送性化合物（例示化合物S-1）に代えた他は同様にして実施例9の感光体を作製した。

【0139】実施例10

〈実施例10の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、スチルベン型電荷輸送性化合物（例示化合物S-4）に代えた他は同様にして実施例10の感光体を作製した。

【0140】実施例11

〈実施例11の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、スチルベン型電荷輸送性化合物（例示化合物S-8）に代えた他は同様にして実施例11の感光体を作製した。

【0141】実施例12

〈実施例12の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、ベンジジン型電荷輸送性化合物（例示化合物B-e-1）に代えた他は同様にして実施例12の感光体を作製した。

【0142】実施例13

〈実施例13の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、ベンジジン型電荷輸送性化合物（例示化合物B-e-4）に代えた他は同様にして実施例13の感光体を作製した。

【0143】実施例14

〈実施例14の感光体の作製〉実施例1の感光体の保護

層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、ベンジジン型電荷輸送性化合物（例示化合物Be-6）に代えた他は同様にして実施例14の感光体を作製した。

【0144】実施例15

〈実施例15の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、プタジェン型電荷輸送性化合物（例示化合物Bu-1）に代えた他は同様にして実施例15の感光体を作製した。

【0145】実施例16

〈実施例16の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、その他の電荷輸送性化合物例示化合物（So-1）に代えた他は同様にして実施例16の感光*

チタンキレート化合物「TC-750」（松本製薬社製）	200g
シランカップリング剤「KBM-503」（信越化学社製）	130g
2-プロパノール	1000ml
水	30ml

次いで、上記接着層上に、市販の硬化性シロキサン樹脂「KP-854」（信越化学社製）60重量部、イソプロパノール60重量部を加えて、均一に溶解し、実施例1と同様にトリアリールアミン型電荷輸送性化合物（例示化合物T-1）6重量部を混合して得た塗布液を塗布し、120℃・1時間の乾燥を行い乾燥膜厚1μmの保護層を形成して実施例18の感光体を作製した。

【0149】実施例19

〈実施例19の感光体を作製〉実施例18の保護層のシロキサン樹脂「KP-854」の代わりにシロキサン樹※

チタンキレート化合物「TC-100」（松本製薬社製）	200g
シランカップリング剤「KBM-903」（信越化学社製）	130g
トルエン	1000ml
水	30ml

次いで、上記接着層上に、実施例18のシロキサン樹脂「KP-854」の代わりにシロキサン樹脂「X-40-2269」（信越化学社製）を用いた以外は全く同様にして保護層を形成し実施例20の感光体を作製した。

【0152】実施例4～20の感光体の評価は実施例1の感光体の場合と同様にして行なわれ、20℃60%RH、30℃80%RH環境下の、どちらの環境条件でも初期及び10万枚ともカブリも発生せず、且つ黒ベタ部の濃度は反射濃度で1.2以上の濃度が得られ、均一性の優れた画像が得られた。又、10万枚終了時点の感光体の摩耗量も0.1μm以下と非常に少なかった。更に感光体表面のキズが殆ど見られず、ハーフトーン画像上にもスリ傷による画像欠陥は見られなかった。また、感光層の剥離も見られなかった。

【0153】実施例21

実施例1の感光体の保護層にヒンダードフェノール化合物（例示化合物1-32）0.9重量部を添加した以外

*体を作製した。

【0146】実施例17

〈実施例17の感光体の作製〉実施例1の感光体の保護層のトリアリールアミン型電荷輸送性化合物（例示化合物T-1）を、その他の電荷輸送性化合物例示化合物（So-3）に代えた他は同様にして実施例17の感光体を作製した。

【0147】実施例18

〈実施例18の感光体の作製〉実施例1の感光体の中間層に代えて、下記組成物を攪拌混合して得た塗布液を支持体上に浸漬塗布し、150℃30分間乾燥して厚さ1.0μmの中間層を形成し、かつ該中間層上に実施例1と同様のCGL、CTL及び接着層を形成した。

【0148】

20※脂「X-40-2239」（信越化学社製）を用いた以外は全く同様にして実施例19の感光体を作製した。	
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【0150】実施例20

実施例18の中間層に代えて下記組成物を攪拌混合して得た塗布液を支持体上に浸漬塗布し、150℃30分間乾燥して厚さ1.0μmの中間層を形成し、かつ該中間層上に実施例1と同様のCGL、CTL及び接着層を形成した。

【0151】

20※脂「X-40-2239」（信越化学社製）を用いた以外は全く同様にして実施例21の感光体を作製した。	
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【0154】実施例22

実施例1の感光体の保護層に、ヒンダードフェノールアミン化合物（例示化合物2-1）0.6重量部を添加した以外は同様にして実施例22の感光体を作製した。

【0155】実施例21及び22の感光体を実施例1の感光体の場合と同様にして評価した。

【0156】20℃60%RH、30℃80%RH環境下の、どちらの環境条件でも初期及び10万枚ともカブリも発生せず、且つ黒ベタ部の濃度は反射濃度で1.3以上の濃度が得られ、均一性の優れた画像が得られた。又、10万枚終了時点の感光体の摩耗量も0.1μm以下と非常に少なかった。更に感光体表面のキズが殆ど見られず、ハーフトーン画像上にもスリ傷による画像欠陥は見られなかった。また、感光層の剥離も見られなかった。なお、実施例21及び22の感光体では、保護層中に酸化防止剤が含有されているため、該酸化防止剤が含

有されいない実施例1～20の感光体に比してより高濃度で鮮明な画像が得られた。

【0157】実施例1～22及び比較例1及び2から、実施例の感光体は高温高湿下で繰り返し10万回に及ぶ画像形成を行った場合でも感光体の膜厚摩耗量が少なく、カブリや画像ボケ、膜はがれ、傷等の発生がなく、高濃度鮮明な画像が得られるが、比較例の感光体はそれらの何れかが悪く、実用性に乏しいことがわかる。

【0158】

【発明の効果】実施例により実証されたように、本発明の感光体、それを用いたプロセスカートリッジ及び画像形成装置によれば、感光層表面の硬度が高く、耐摩耗性、耐傷性や接着性に優れており、繰り返して画像形成を行った場合、特に高温高湿下で繰り返して画像形成を行った場合でも電子写真性能の疲労劣化を生ずること

がなく、カブリや画像ボケ等を生ぜず良好な画像が安定して得られる等優れた効果を有する。

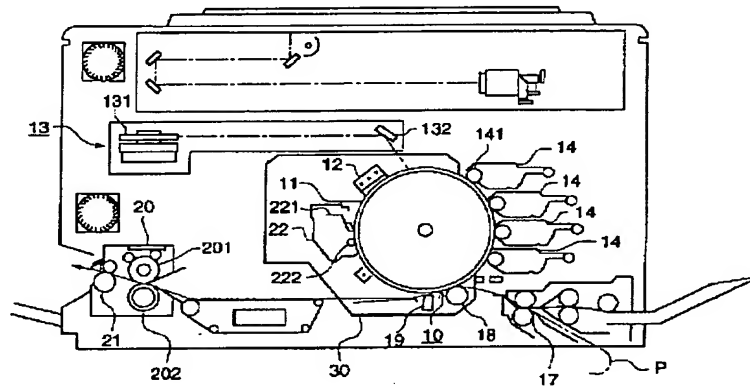
【図面の簡単な説明】

【図1】画像形成装置の断面図である。

【符号の説明】

- 10 感光体ドラム
- 12 帯電器
- 13 像露光器
- 14 現像器
- 18 転写ローラ
- 19 分離器
- 20 定着装置
- 22 クリーニング器
- 30 プロセスカートリッジ

【図1】



フロントページの続き

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(54) ELECTROPHOTOGRAPHIC PHOTORECEPTOR AND PROCESS CARTRIDGE AND IMAGE FORMING DEVICE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a photoreceptor excellent in wear resistance, scratch resistance or the like by incorporating a specified siloxane hardening resin into the surface layer of an electrophotographic photoreceptor and incorporating an org. metal compd. and/or silane coupling agent into an intermediate layer.

SOLUTION: The surface layer of the electrophotographic photoreceptor contains a siloxane hardening resin

containing a structural unit expressed by the formula,

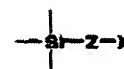
and the intermediate layer contains an org. metal compd. and/or silane coupling agent. In the formula, X is a

donating group of charge transfer ability and is coupled

to Z in the formula through the carbon atom which

constitutes the donating group, Z is a divalent or higher-

valence atom or group except for the adjacent coupling atoms (Si and C). The divalent or higher- valence atom or group Z except for the adjacent coupling atoms (Si and C) preferably means a divalent or higher-valence atoms or groups such as an oxygen atom (O), sulfur atom



(S) and NR (R is a hydrogen atom or monovalent org. group).

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

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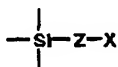
CLAIMS

[Claim(s)]

[Claim 1] The electrophotography photo conductor characterized by being a layer containing the siloxane system hardening resin in which the surface layer of this electrophotography photo conductor contains the structural unit shown by the following general formula (1) in the electrophotography photo conductor which has a photosensitive layer through an interlayer on a conductive base material, and being the layer in which this interlayer contains an organometallic compound and/or a silane coupling agent.

[Formula 1]

一般式(1)



(X is a charge transportation ability grant machine among a formula, it is the basis combined with Z in a formula through the carbon atom which constitutes this grant machine, and Z is the atom or basis more than divalent [other than an adjoining joint atom (Si and C)].)

[Claim 2] It is the electrophotography photo conductor according to claim 1 which X is a charge transportation ability grant machine, it is the basis combined with Z in a formula through the carbon atom which constitutes this grant machine, and Z is an oxygen atom (O), a sulfur atom (S), or NR basis, and is characterized by R being a hydrogen atom or a univalent organic machine in the aforementioned general formula (1).

[Claim 3] The electrophotography photo conductor according to claim 1 or 2 characterized by the organometallic compound contained in the aforementioned interlayer being a metal alkoxide or an organic metal chelate.

[Claim 4] An electrophotography photo conductor given in any 1 term of the claims 1-3 characterized by being the layer in which the aforementioned interlayer contains an organic metal chelate and a silane coupling agent.

[Claim 5] The electrophotography photo conductor according to claim 3 or 4 characterized by showing the organic metal chelate contained in the aforementioned interlayer by the following general formula (2).

General formula (2) (R¹O) l-M-(K) m (R¹ is an alkyl group among a formula, M expresses a zirconium, titanium, or aluminum, the chelate formation machine K expresses an acetoacetic ester machine or beta diketone residue, and l and m express one or more integers.) However, when M is a zirconium or titanium, l+m is 4, and l+m is 3 when M is aluminum.

[Claim 6] An electrophotography photo conductor given in any 1 term of the claims 1-4 to which the silane coupling agent contained in the aforementioned interlayer is characterized by what is shown by the following general formula (3).

general formula (3) (Q) p-Si(Y) q-(A) r (as for the inside Q of a formula, a halogen atom, an alkoxy group, or the amino group is expressed, A expresses an alkyl group or an aryl group, and the organic

functional group Y expresses -BOOC(R') C=CH₂, -BNHR", or -BNH₂.) R' expresses an alkyl group, R " of alkyl groups or aryl groups is expressed, and B expresses the alkylene machine containing an alkylene machine or -O-, -NH-, and -CO-. p and q express one or more integers, r expresses zero or more integers, and p+q+r is 4.

[Claim 7] An electrophotography photo conductor given in any 1 term of the claims 1-6 characterized by the aforementioned surface layer containing hindered amine or a hindered phenolic compound.

[Claim 8] Image formation equipment characterized by carrying out image formation to any 1 term of the aforementioned claims 1-7 through electrification, image exposure, development, an imprint, separation, and cleaning using the electrophotography photo conductor of a publication.

[Claim 9] The process cartridge characterized by being built by any 1 term of the aforementioned claims 1-7 combining the electrophotography photo conductor of a publication, and at least one of an electrification machine, an image photographic filter, a development counter, an imprint machine, an eliminator, and the cleaning machines.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] It is related with the process cartridge and image formation equipment carrying the electrophotography photo conductor and this electrophotography photo conductor.

[0002]

[Description of the Prior Art] Although the inorganic photo conductor containing the inorganic photoconductivity matter was conventionally used for the electrophotography photo conductor, many organic photo conductors which replace with an inorganic photo conductor in recent years, and contain the organic photoconductivity matter came to be used. although that it is easy to develop the material corresponding to the various exposure light sources from the light to infrared light at the above-mentioned organic photo conductor (henceforth a photo conductor), that material without environmental pollution can be chosen, that a manufacturing cost is cheap, etc. have many points of having excelled as compared with the inorganic photo conductor -- the only fault -- a mechanical strength -- weak -- many - it is that wear a photosensitive-layer front face out, are damaged at the time of the copy of several sheets, or a print, and an electrophotography performance tends to deteriorate

[0003] Since electric and mechanical external force is applied directly, the wear injury of the front face of the above-mentioned photo conductor is easy to be carried out with an electrification machine, a development counter, an imprint machine, an eliminator, a cleaning vessel, etc., and the improvement of endurance to them is demanded. Specifically, the improvement of mechanical endurance to film peeling by wear on the front face of a photo conductor by ****, generating of a blemish, mixing of a foreign matter, the shock at the time of paper jam processing, etc. is demanded. About the endurance over the blemish and film peeling by the shock, about the same intensity as an inorganic photo conductor is called for strongly especially. Moreover, the endurance over degradation of the photo conductor front face by ozone, active oxygen, etc. which are generated at the time of corona electrical charging etc. is also demanded.

[0004] In order to fulfill various properties requested from the above photo conductor front faces, the former various improvement method is proposed. That is, it is reported by by using a BPZ polycarbonate as a binder resin on the surface of a photo conductor that a surface wear property, a toner filming property, etc. are improved. Moreover, using the hardenability silicone resin containing colloidal silica for the protective layer of the front face of a photo conductor is reported by JP,6-118681,A.

[0005] However, in the photo conductor using the BPZ polycarbonate as a binder resin, in addition, antiwear characteristics run short and it does not have satisfying endurance. Although improved, the electrophotography property at the time of repeat use was inadequate, at the time of repeat use, it was easy to generate fogging and picture dotage, and the endurance of the surface layer of the hardenability silicone resin which contains colloidal silica on the other hand was inadequate [the antiwear characteristic].

[0006] As a method of improving such a fault, the photo conductor which has the resin layer which

combined the electron hole transportability compound in the hardenability organic Si system macromolecule as a surface layer is proposed by JP,9-124943,A and JP,9-190004,A. However, this resin layer does not have sufficient endurance that it is easy to generate fogging and picture dotage under a high-humidity environment. Moreover, there was a fault, like such a hardenability organic Si compound film tends to produce film peeling of a photosensitive layer in although abrasion resistance is high, if a blemish tends to be attached to an external shock, and the film intensity of a photosensitive layer and the adhesive property were inadequate.

[0007]

[Problem(s) to be Solved by the Invention] The place which this invention is proposed based on the above-mentioned actual condition, and is made into the purpose The degree of hardness on the front face of a photosensitive layer is high, and it excels in abrasion resistance, and ****-proof and an adhesive property. Even when image formation is performed repeatedly and image formation is especially performed repeatedly under high-humidity/temperature, defatigation degradation of the electrophotography performance of a photo conductor is not produced. Neither fogging nor picture dotage is produced, but it is in offering the process cartridge and image formation equipment using the photo conductor and this photo conductor with which a good picture is acquired by being stabilized.

[0008]

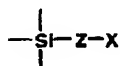
[Means for Solving the Problem] Things for which the above-mentioned purpose is attained by the following composition as a result of wholeheartedly examination, such as this invention person, were found out.

[0009] 1. Electrophotography photo conductor characterized by being layer containing siloxane system hardening resin in which surface layer of this electrophotography photo conductor contains structural unit shown by following general formula (1) in electrophotography photo conductor which has photosensitive layer through interlayer on conductive base material, and being layer in which this interlayer contains organometallic compound and/or silane coupling agent.

[0010]

[Formula 2]

一般式(1)



[0011] (X is a charge transportation ability grant machine among a formula, it is the basis combined with Z in a formula through the carbon atom which constitutes this grant machine, and Z is the atom or basis more than divalent [other than an adjoining joint atom (Si and C)].)

2. It is an electrophotography photo conductor given in the above 1 characterized by for X being a charge transportation ability grant machine, being the basis combined with Z in a formula through the carbon atom which constitutes this grant machine, for Z being an oxygen atom (O), a sulfur atom (S), or NR basis, and R being a hydrogen atom or a univalent organic machine in the aforementioned general formula (1).

[0012] 3. The above 1 characterized by organometallic compound contained in aforementioned interlayer being metal alkoxide or organic metal chelate, or electrophotography photo conductor given in 2.

[0013] 4. Electrophotography photo conductor given in which 1st term of the above 1-3 characterized by being layer in which aforementioned interlayer contains organic metal chelate and silane coupling agent.

[0014] 5. The above 3 characterized by showing organic metal chelate contained in aforementioned interlayer by following general formula (2), or electrophotography photo conductor given in 4.

[0015] General formula (2) (R1O) l-M-(K) m (R1 is an alkyl group among a formula, M expresses a zirconium, titanium, or aluminum, the chelate formation machine K expresses an acetoacetic ester machine or beta diketone residue, and l and m express one or more integers.) However, when M is a

zirconium or titanium, $l+m$ is 4, and $l+m$ is 3 when M is aluminum. Electrophotography photo conductor given in any 1 term of the above 1-4 with which the silane coupling agent contained in the 6.

aforementioned interlayer is characterized by what is shown by the following general formula (3).

[0016]

general formula (3) $p\text{-Si(Y)} q\text{-(A)} r$ (as for the inside Q of a formula, a halogen atom, an alkoxy group, or the amino group is expressed, A expresses an alkyl group or an aryl group, and the organic functional group Y expresses -BOOC(R') C=CH_2 , -BNHR ", or -BNH_2 .) R' expresses an alkyl group, R " of alkyl groups or aryl groups is expressed, and B expresses the alkylene machine containing an alkylene machine or -O- , -NH- , and -CO- . p and q express one or more integers, r expresses zero or more integers, and $p+q+r$ is 4.

7. Electrophotography photo conductor given in any 1 term of the above 1-6 characterized by aforementioned surface layer containing hindered amine or hindered phenolic compound.

[0017] 8. Image formation equipment characterized by carrying out image formation to any 1 term of the above 1-7 through electrification, image exposure, development, imprint, separation, and cleaning using electrophotography photo conductor of publication.

[0018] 9. Process cartridge characterized by being built by any 1 term of the above 1-7 combining electrophotography photo conductor of publication, and at least one of electrification machine, image photographic filter, development counter, imprint machine, eliminator, and the cleaning machines.

[0019] this invention is explained in detail.

[0020] The photo conductor of this invention is a photo conductor which comes to prepare a photosensitive layer on a conductive base material through an interlayer. The feature is in the point that the surface layer of this photo conductor consists of siloxane system hardening resin containing the structural unit which has the charge transportation ability grant machine shown by the aforementioned general formula (1) in structure. The feature is in the point that furthermore this interlayer consists of a layer containing an organometallic compound especially the organometallic compound of the aforementioned general formula (2), and/or the silane coupling agent of the aforementioned general formula (3), and the photo conductor of high endurance peculiar to this invention is obtained by it.

[0021] <Composition of a surface layer> The surface layer of the photo conductor of this invention is a layer which consists of the siloxane system hardening resin containing the charge transportation ability grant machine X of the aforementioned general formula (1). this siloxane system hardening resin For example, the alkyl (poly) siloxane system compound and/or aromatic (poly) siloxane system compound which have adding-water resolvability machines, such as a silanol group or an alkoxy group Make the charge transportability compound which has a functional group containing the atom or Basis Z more than divalent [other than the charge transportation ability grant machine X of the aforementioned general formula (1), and an adjoining joint atom (Si and C)] react, and add a cross linking agent or a curing catalyst as occasion demands, and it is made to harden, and is obtained.

[0022] With in addition, the atom more than divalent [other than the adjoining joint atom (Si and C) as used in the field of this invention] or Basis Z It is the atom or basis more than divalent [, such as an oxygen atom (O), a sulfur atom (S), or NR (R is a hydrogen atom or a univalent organic machine),] preferably. the charge transportation ability grant machine X in the aforementioned general formula (1) this -- through Z, it is combined with the silicon atom (Si) of the aforementioned (poly) siloxane system compound, bridge formation hardening is carried out, and target siloxane system hardening resin is obtained In addition, when Z is NR, R may be a hydrogen atom or a univalent organic machine, and this organic machine may be the charge transportation ability grant machine X.

[0023] << -- compound>> containing the charge transportation ability grant machine X -- it is in the structure included in the siloxane system hardening resin as used in the field of this invention, and as a charge transportability compound which has the functional group of the functional group containing the charge transportation ability grant machines X and Z of the aforementioned general formula (1), for example, OH and SH, and NH₂ grade, it divides roughly and there are an electron hole transportability (p type charge transportability) compound and an electronic transportability (n type charge transportability) compound As the above-mentioned p type charge transportability compound, an

oxazole, an OKISA diazole, a thiazole, a triazole, an imidazole, imidazolone, imidazoline, screw imidazolidine, styryl, a hydrazone, a benzidine, a pyrazoline, a stilbene compound, an amine, oxazolone, a benzothiazole, a bends imidazole, quinazoline, a benzofuran, an acridine, a phenazine, an amino stilbene, Polly N-vinylcarbazole, a Polly 1-vinyl pyrene, a Polly 9-vinyl anthracene, or its derivative mentions, for example,

[0024] As an n type charge transportability compound, for example Furthermore, a succinic anhydride, a maleic anhydride, Phthalic anhydride, pyromellitic dianhydride, an anhydrous merit acid, a tetracyanoethylene, A tetracyano quinodimethan, a nitrobenzene, a dinitrobenzene, a trinitrobenzene, A tetrapod nitrobenzene, nitrobenzo nitril, PIKURIRU chloride, Quinone crawl imide, a chloranil, BUROMANIRU, a benzoquinone, a naphthoquinone, Diphenquinone, a TOROPO quinone, anthraquinone, 1-chloro anthraquinone, A dinitro anthraquinone, 4-nitrobenzo phenon, 4, and 4'-dinitro benzophenone, 4-nitroglycerine benzal chestnut dinitrile, alpha-cyano-beta-(p-cyano phenyl)-2-(p-chlorophenyl) ethylene, 2, 7-dinitro fluorene, 2 and 4, and 7-trinitro full -- me -- non 2, 4, 5, 7-tetrapod nitroglycerine full ORENON, 9-FURUORENIRIDEN dicyanomethylene MARONO nitril, Poly nitroglycerine-9-FURUORONIRIDEN dicyanomethylene MARONO dinitrile, Although compounds, such as a picric acid, o-nitroglycerine benzoic acid, p-nitroglycerine benzoic acid, 3, 5-dinitro benzoic acid, a pentafluoro benzoic acid, 5-nitroglycerine salicylic acid, 3, 5-dinitro salicylic acid, a phthalic acid, and a merit acid, and these derivatives are mentioned It is not limited to these.

[0025] In addition, it can also express with the detection current value which originates in charge transportation by well-known methods, such as the usual Time-Of-Flight method, as another definition about the charge transportation ability of the structural unit which has the charge transportation ability grant machine X of this invention.

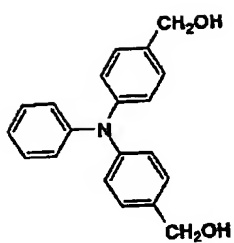
[0026] Moreover, p type charge transportability compound which has the functional group which includes at least one above Z as a compound which contains the charge transportation ability grant machine X in this invention is more desirable, it is a residue except the functional group including the above Z of this p type charge transportability compound, and the corresponding charge transportation ability grant machine X is a basis which C of this residue has combined with Si of a siloxane (poly) system compound through Above Z.

[0027] Also in p type charge transportability compound which has a functional group including at least one above Z, the following compound can be especially mentioned to a desirable this invention as a useful p type charge transportability compound, for example.

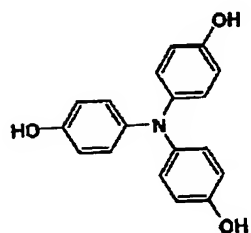
[0028] 1. Triaryl Amine System Compound [0029]

[Formula 3]

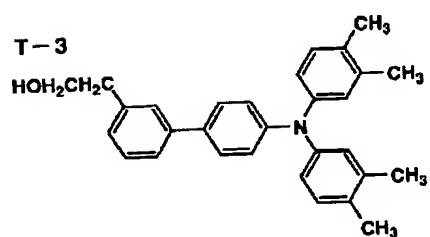
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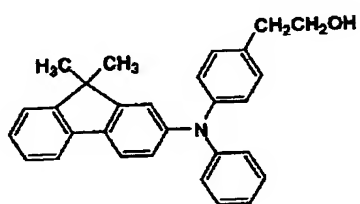
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T-3



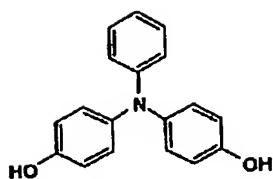
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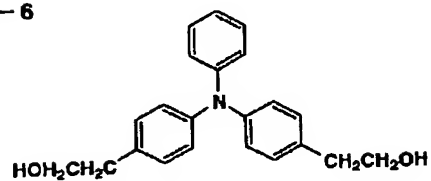
[0030]

[Formula 4]

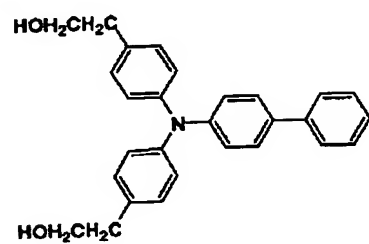
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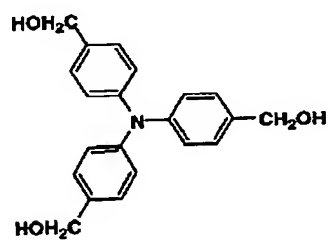
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T-7

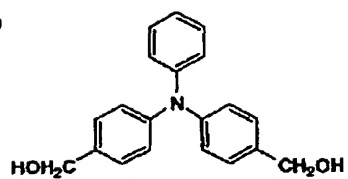


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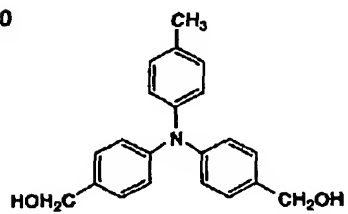


[0031]
[Formula 5]

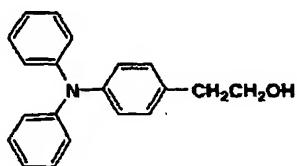
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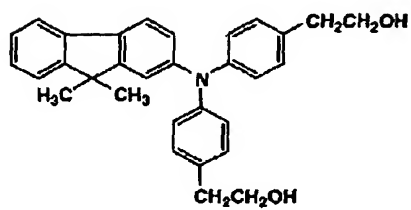
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T-11



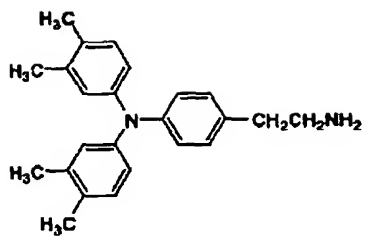
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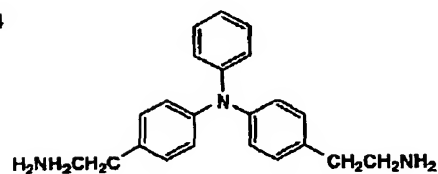
[0032]

[Formula 6]

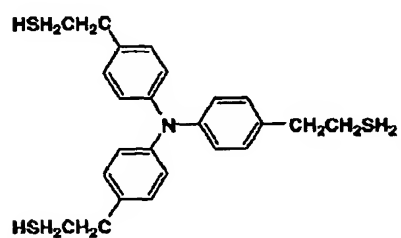
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T-14

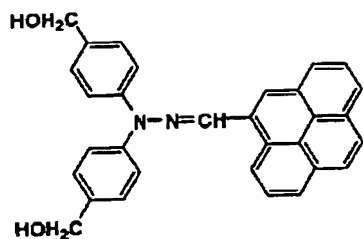


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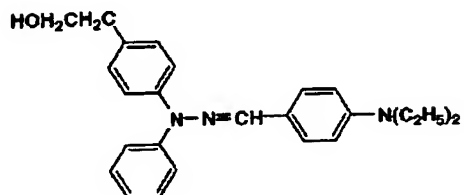


[0033] 2. Hydrazone System Compound [0034]
 [Formula 7]

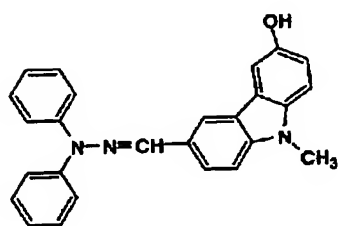
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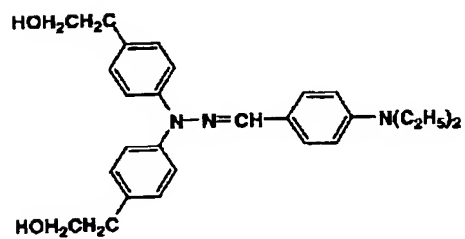
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H-3

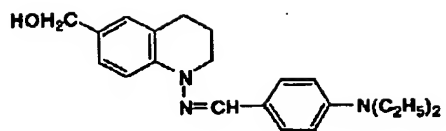


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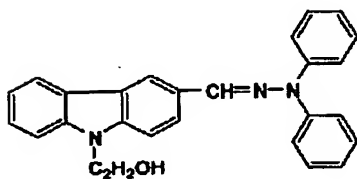


[0035]
[Formula 8]

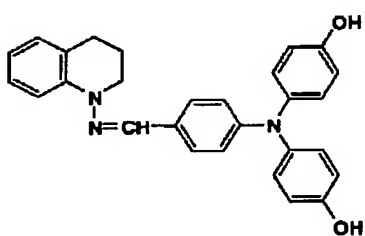
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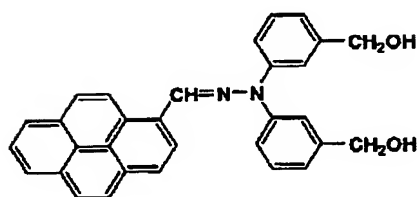
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H-7

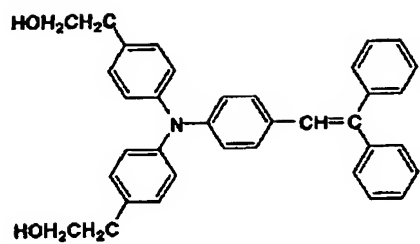


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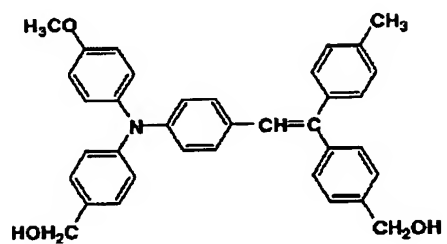


[0036] 3. Stilbene System Compound [0037]
[Formula 9]

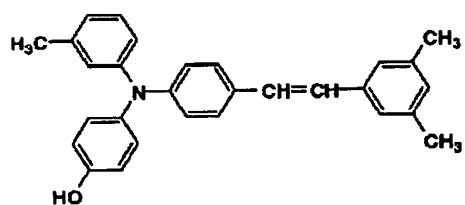
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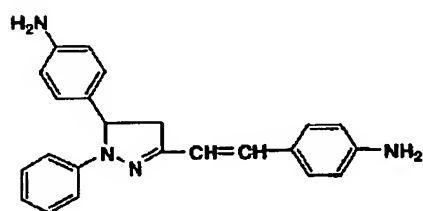
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S-3

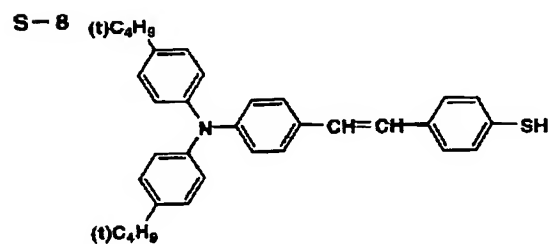
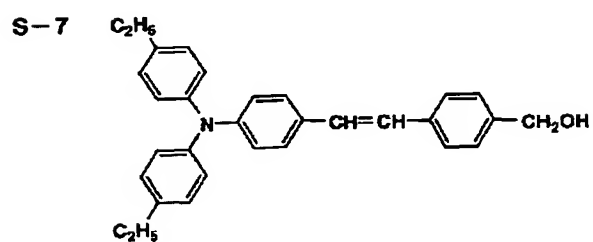
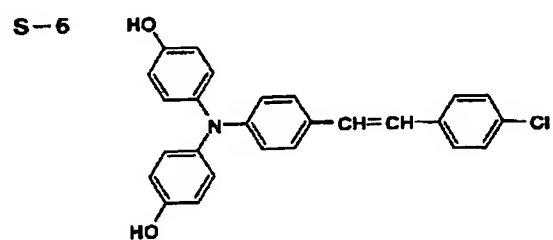
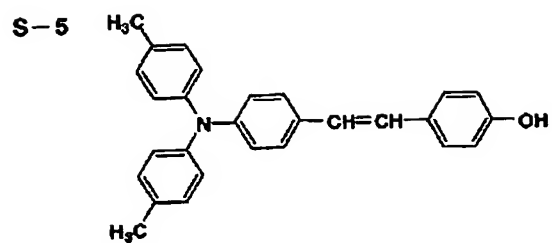


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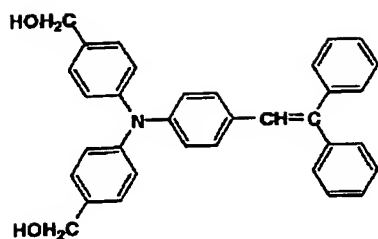
[0038]

[Formula 10]

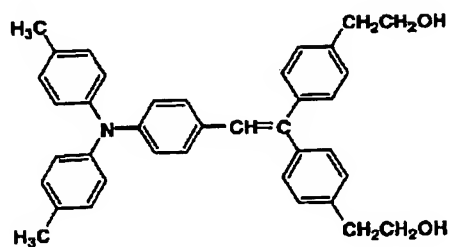


[0039]
[Formula 11]

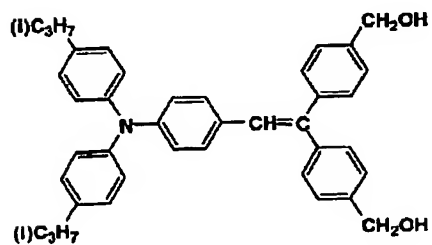
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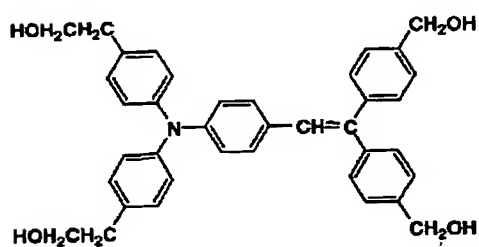
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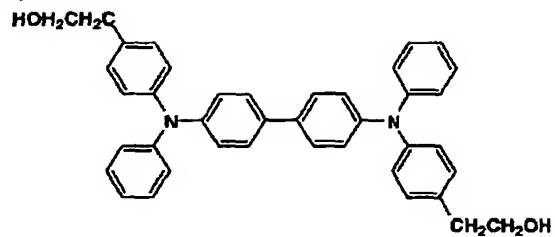
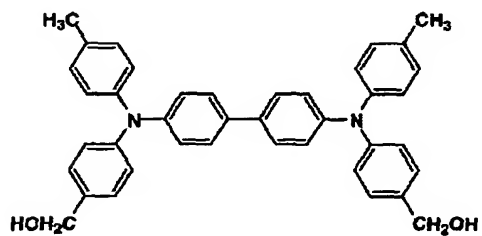
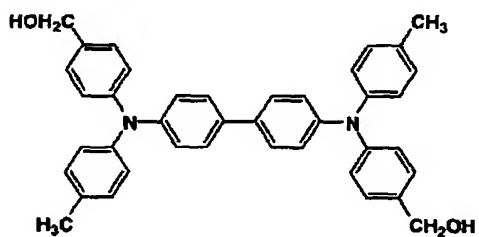
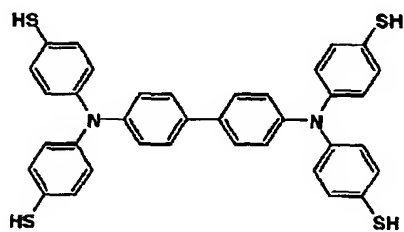
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S-12

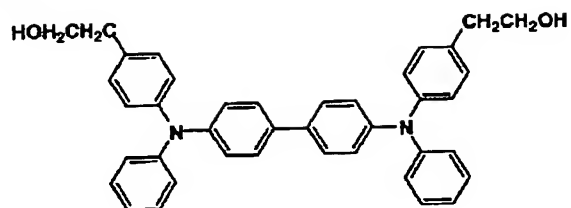
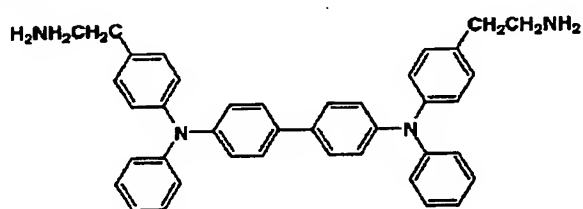
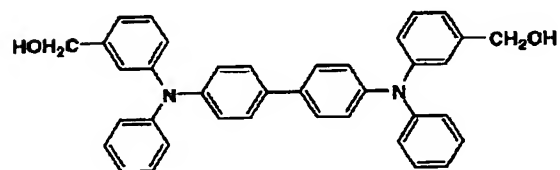


[0040] 4. Benzidine System Compound [0041]
[Formula 12]

Be-1**Be-2****Be-3****Be-4**

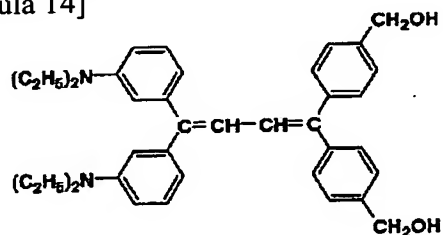
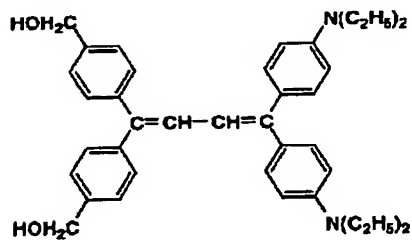
[0042]

[Formula 13]

Be-5**Be-6****Be-7**

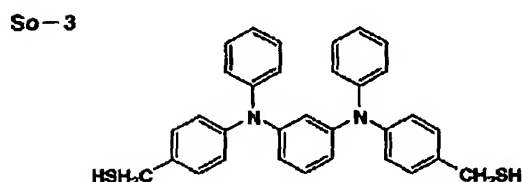
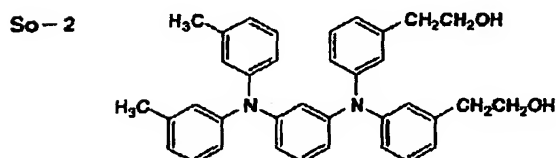
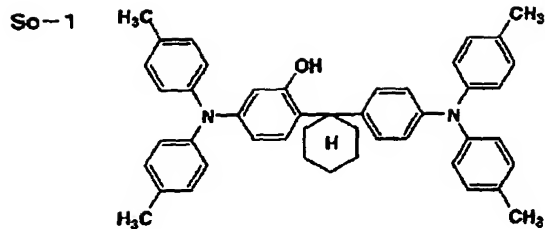
[0043] 5. Butadiene System Compound [0044]

[Formula 14]

Bu-1**Bu-2**

[0045] 6. Other Compounds [0046]

[Formula 15]



[0047] In addition, X of the above-mentioned general formula (1) may exist as a crosslink machine with the aforementioned (poly) siloxane system compound besides the above-mentioned charge transportation ability. In the dryness process after painting of the application constituent containing the siloxane (poly) system compound which could join as a pendant machine and the above-mentioned p type charge transportability compound combined etc. When this polysiloxane system compound constructs a bridge over ** by existence of a cross linking agent, a curing catalyst, etc. as occasion demands (crosslink), a hardening resin layer with a high degree of hardness can be formed.

[0048] <<siloxane system hardening resin>> As siloxane system hardening resin for forming the surface layer of this invention, beforehand, in a structural unit, add a curing catalyst and a cross linking agent to siloxane (poly) system compounds, such as a monomer which has siloxane combination, oligomer, and polymer, as occasion demands, a new chemical bond is made to form, and the three-dimensions network structure is formed. For example, the three-dimensions network structure is made to form by the condensation reaction of alkoxy silane, or the condensation reaction of a silanol. Moreover, you may include a particle like colloidal silica in the three-dimensions network structure.

[0049] In order to carry out the crosslink of formation of the above-mentioned (poly) siloxane system compound, and the ** (poly) siloxane system compound of each other, to make them construct a bridge and to form a hardening resin layer, it is desirable to have a hydroxyl group or the following adding-water resolvability machine as a functional group preferably.

[0050] The adding-water resolvability machine in the above-mentioned (poly) siloxane system compound has the desirable alkoxy group in which carbon numbers, such as a methoxy machine, an ethoxy basis, an acetoxy machine, a propoxy group, a butoxy machine, a methoxyethoxy machine, and a hexa oxy-basis, specifically have the alkyl group of 1-6.

[0051] When several n of the hydroxyl group which has generally combined with Si atom the siloxane system compound used as a raw material of the siloxane system hardenability resin in this invention (poly), or a adding-water resolvability machine is 1, the macromolecule-ized reaction of a siloxane (poly) system compound is suppressed. When n is 2, 3, or 4, a macromolecule-ized reaction tends to occur, and it is possible especially to advance crosslinking reaction highly by 3 or 4. Therefore, the shelf

life of application ****, a degree of hardness of an application layer, etc. which are obtained by controlling these are controllable.

[0052] The content rate of the charge transportation ability grant machine X contained in the siloxane system hardening resin layer which is a surface layer (protective layer) of this invention has 1 - 70% of the weight of a preferably desirable range. less than 1 % of the weight -- repeating -- the process of image formation -- a sensitivity fall and generating of fogging -- a large next door and a good picture -- **** -- not having -- becoming -- if 70 % of the weight is exceeded -- repeating -- the process of image formation -- a potential fall -- the concentration fall of a picture -- a large next door -- a clear picture is no longer acquired

[0053] Moreover, in less than 0.01 micrometers, the thickness of the surface layer (protective layer) of this invention usually has desirable 0.01-10 micrometers, a photosensitive layer carries out wear damage in process of image formation repeatedly, and it is easy to carry out fatigue degradation of the photo conductor, and if 10 micrometers is exceeded, an electrophotography performance will fall and good image formation will become [fogging] being easy to increase difficult.

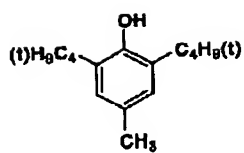
[0054] Antioxidant>> added by <<surface layer In order to fully prevent fatigue degradation of the electrophotography performance of the photo conductor in the process of the image formation repeated in this invention again, it is desirable to contain an antioxidant in a surface layer, and it is desirable to contain hindered amine, a hindered phenolic compound, a phosphorus compound, or a sulfur compound especially.

[0055] The example of a compound which can be preferably used by this inventions, such as a hindered amine compound, a hindered phenolic compound, a phosphorus compound, and a sulfur compound, is shown below.

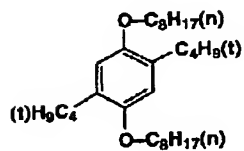
[0056]

[Formula 16]

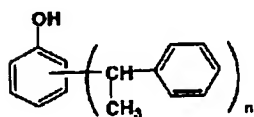
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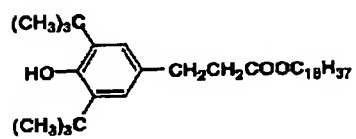
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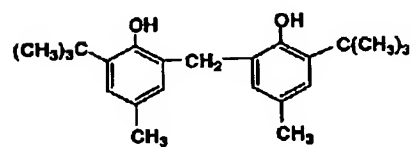
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1-4



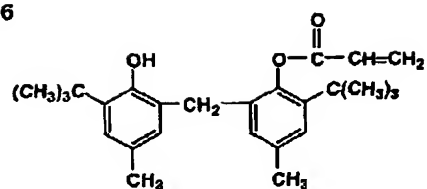
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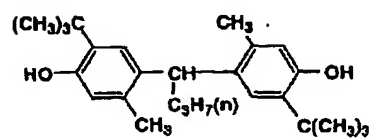
[0057]

[Formula 17]

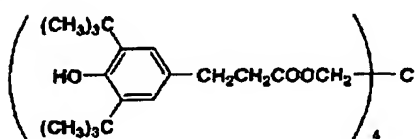
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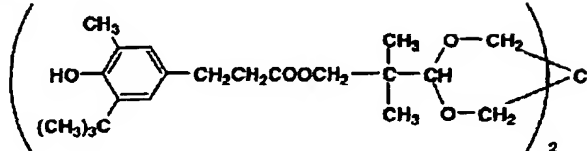
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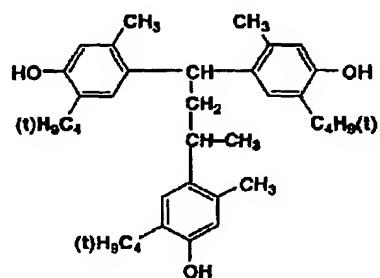
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1-9



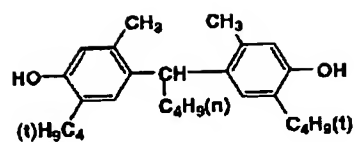
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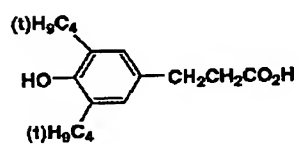
[0058]

[Formula 18]

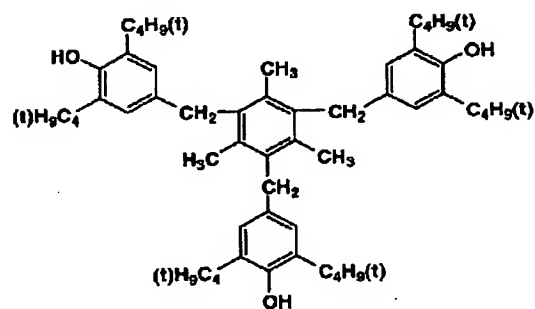
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1-12



1-13



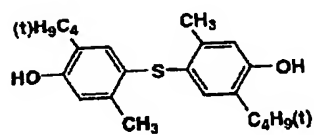
[0059]

[Formula 19]

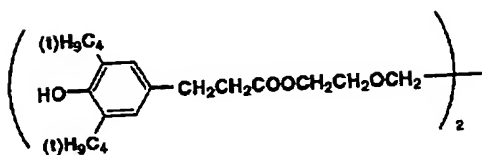
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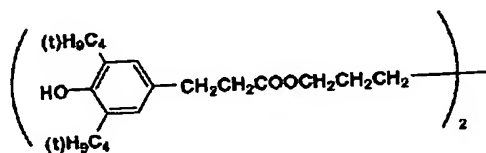
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1-16



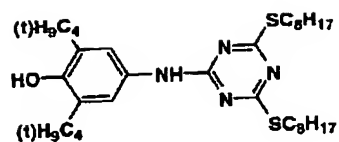
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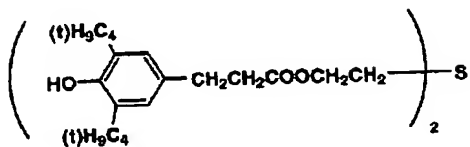
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[Formula 20]

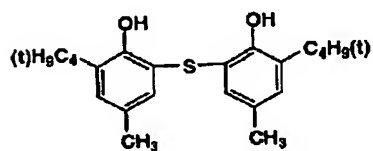
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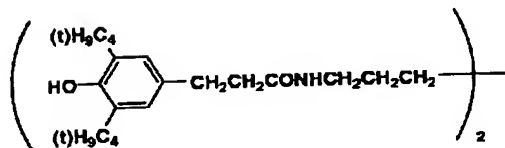
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1-20



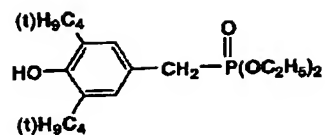
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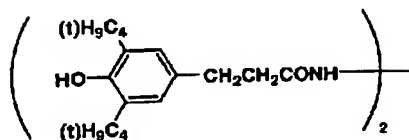
[0061]

[Formula 21]

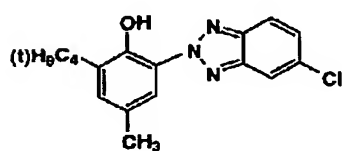
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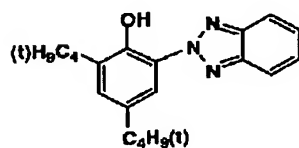
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1-24



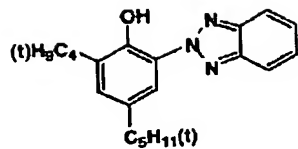
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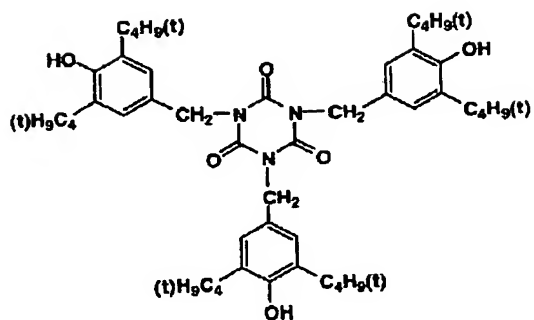
[0062]

[Formula 22]

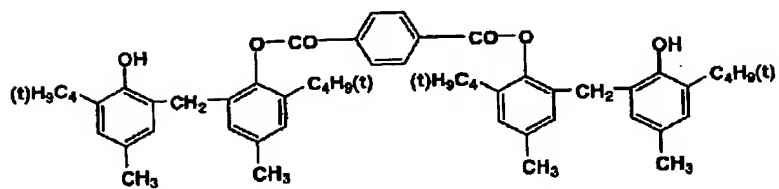
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1-27

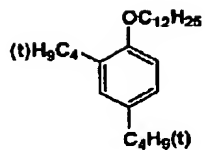


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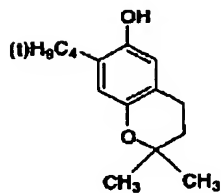


[0063]
[Formula 23]

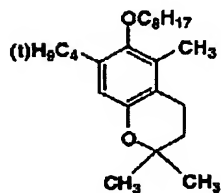
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1-30

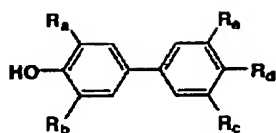


1-31



[0064]

[Formula 24]

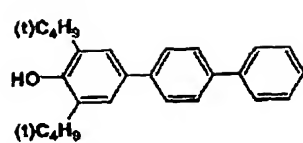


	R_a	R_b	R_c	R_d	R_e
1-32	Bu(t)	Bu(t)	H	H	H
1-33	Bu(t)	Bu(t)	H	CH ₃	H
1-34	Bu(t)	Bu(t)	Bu(t)	H	Bu(t)
1-35	Bu(t)	Bu(t)	Bu(t)	OH	Bu(t)
1-36	Bu(t)	H	H	H	H
1-37	C ₆ H ₁₁ (t)	C ₅ H ₁₁ (t)	H	H	H
1-38	C ₅ H ₁₁ (t)	H	H	H	H
1-39	Bu(t)	CH ₃	H	H	H

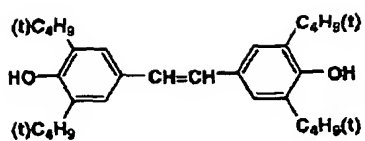
[0065]

[Formula 25]

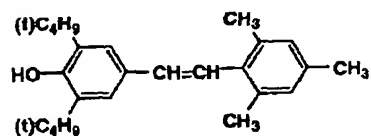
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1-41



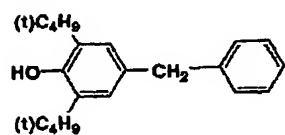
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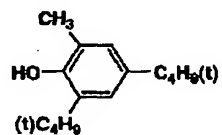
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1-44



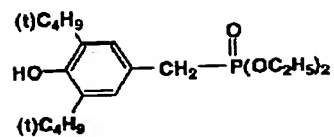
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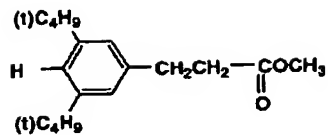
[0066]

[Formula 26]

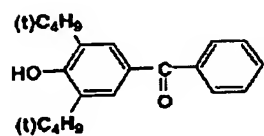
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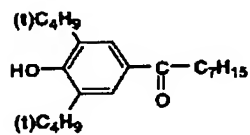
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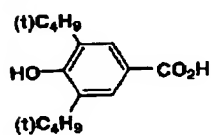
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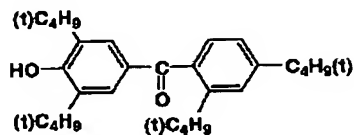
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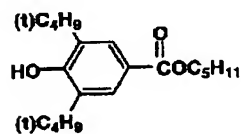
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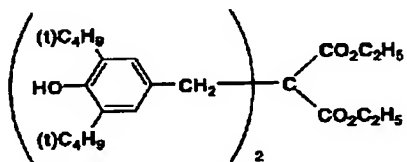
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1-52



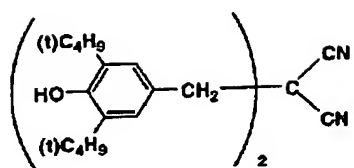
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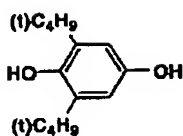
[0067]

[Formula 27]

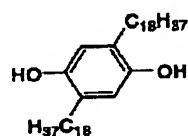
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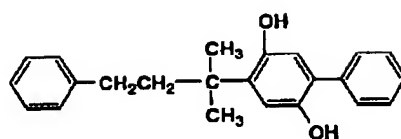
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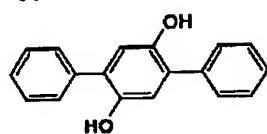
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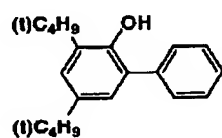
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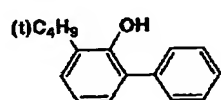
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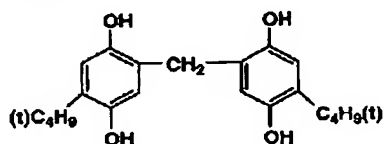
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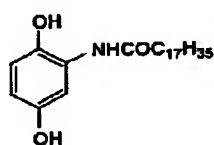
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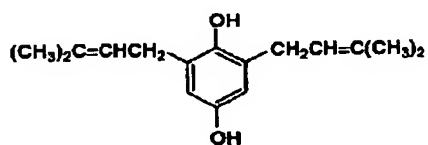
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1-62

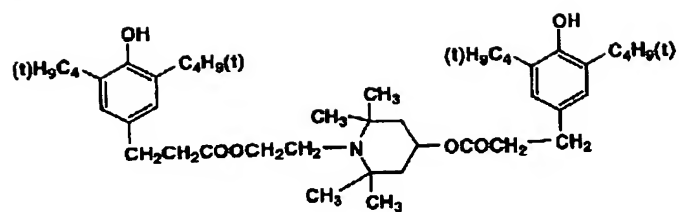


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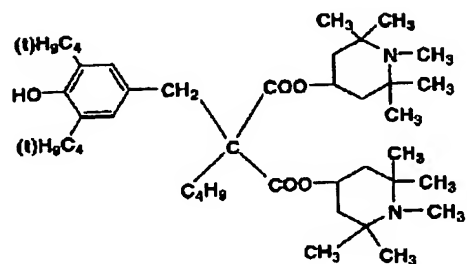


[0068]
[Formula 28]

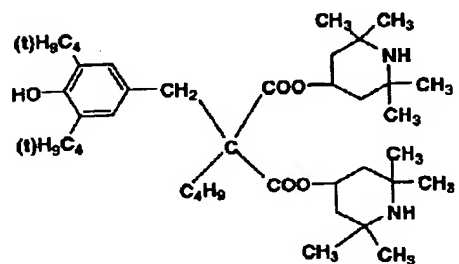
2-1



2-2



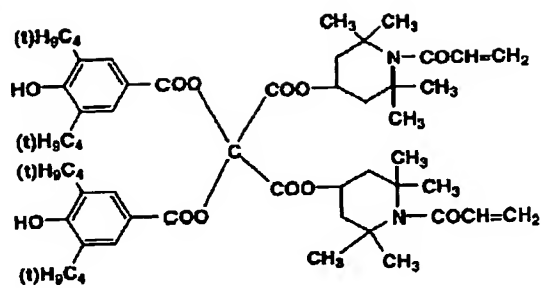
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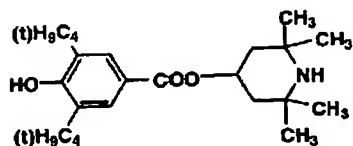
[0069]

[Formula 29]

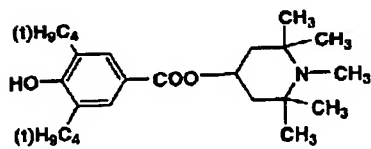
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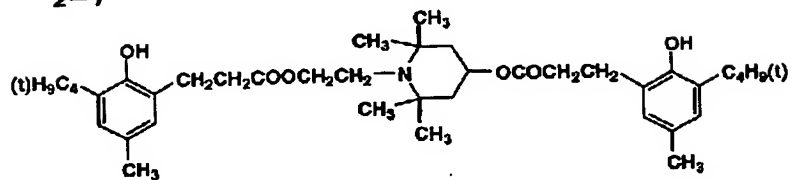
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2-6



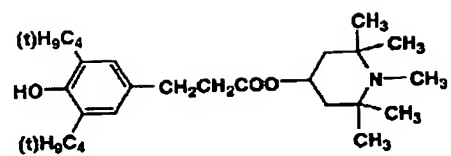
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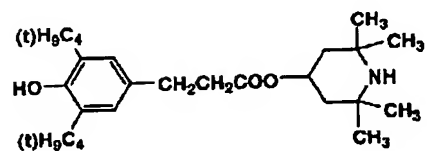
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[Formula 30]

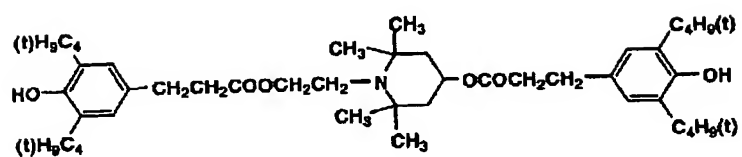
2-8



2-9



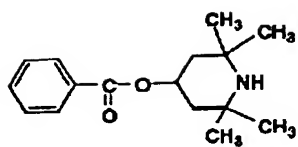
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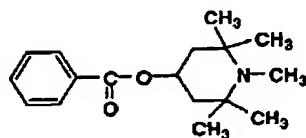
[0071]

[Formula 31]

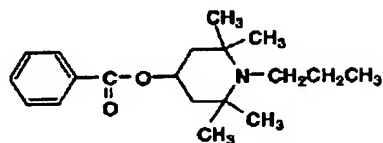
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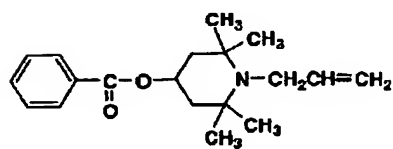
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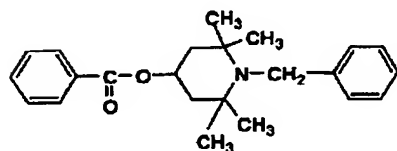
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2-14



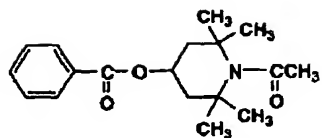
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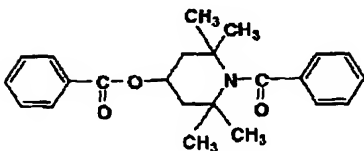
[0072]

[Formula 32]

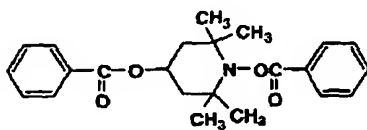
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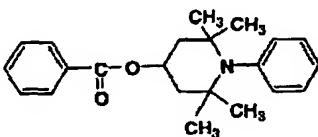
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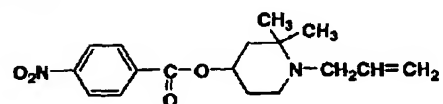
2-18



2-19



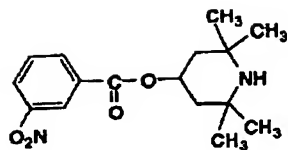
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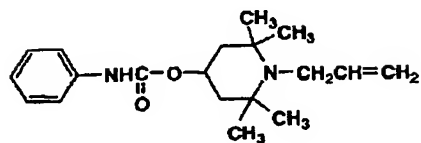
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[Formula 33]

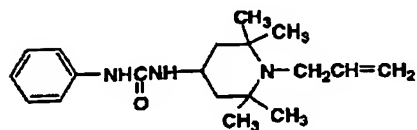
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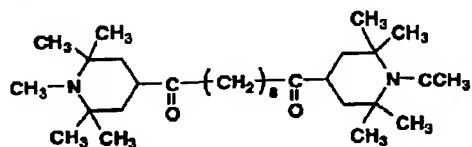
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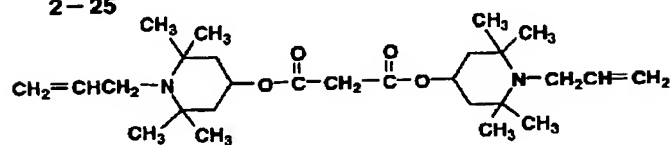
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2-24



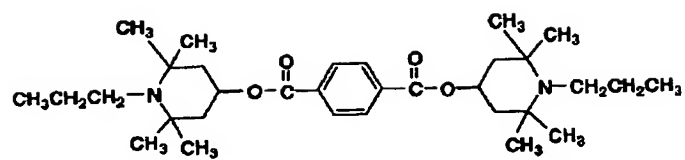
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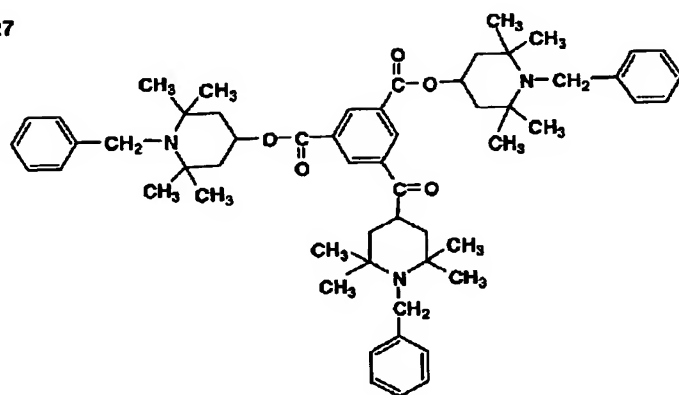
[0074]

[Formula 34]

2-26



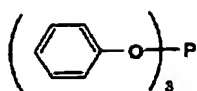
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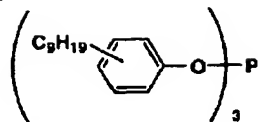
[0075]

[Formula 35]

3-1



3-2



3-3



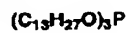
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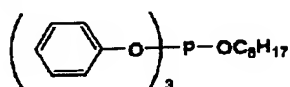
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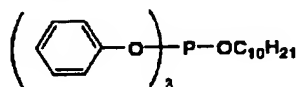
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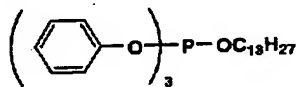
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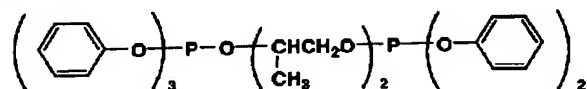
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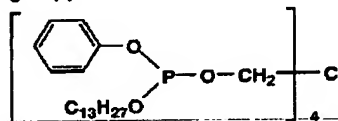
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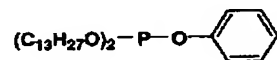
3-10



3-11

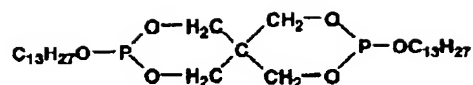


3-12

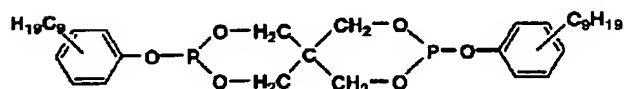


[0076]
[Formula 36]

3-13



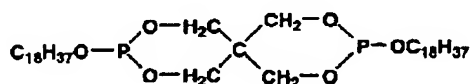
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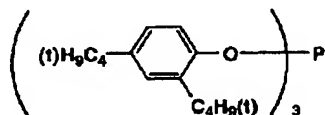
3-15



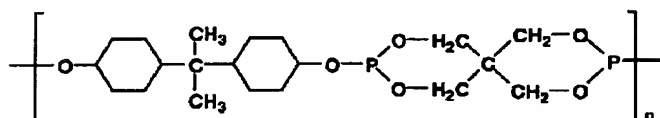
3-16



3-17



3-18



[0077]

[Formula 37]

4-1



4-2



4-3



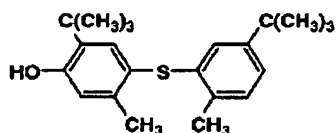
4-4



4-5



4-6



[0078] <An interlayer's composition> Next, it has the feature for the photo conductor of this invention to prepare the interlayer containing an organometallic compound and/or a silane coupling agent between this conductive base material and a photosensitive layer, when securing the outstanding quality of image

and outstanding adhesive property at the time of preparing a photosensitive layer on a conductive base material, and performing image formation.

[0079] <<organometallic compound and silane coupling>> as an organometallic compound contained in the interlayer of the photo conductor of this invention For example, a zirconium tetrapod-n-PUROPI rate, aluminum isopropylate, You may be alkoxide compounds, such as a Monod sec-butoxy aluminum-i-PUROPI rate and aluminum-sec-butyrate. the [moreover, / of a periodic table] -- the [1a group and] - - the [1b group and] -- the [2a group and] -- the [3a group and] -- the [3b group and] -- the [4a group and] -- the [4b group and] -- the [5a group and] -- with the metal atom chosen from 5b group and the 8th group You may be the organic metal chelate compound which comes to carry out molecule coordination by acetoacetic ester, beta diketone, the acetylacetone, the catechol, ethylenediamine, o-phenylene bisdimethyl aniline, etc. in the range of 3, 4, 6, and 8 molecule as a chelating agent.

[0080] However, it is desirable to contain combining the silane coupling agent shown by the aforementioned general formula (3) with this organic metal chelate compound, using the organic metal chelate compound shown to the interlayer of the photo conductor of this invention by the aforementioned general formula (2) as the above-mentioned organometallic compound.

[0081] In the aforementioned general formula (2), R1 is a low-grade alkyl group, M expresses metal atoms, such as a zirconium, titanium, or aluminum, the chelate formation machine K expresses an acetoacetic ester machine or beta diketone residue, and l and m express one or more integers. However, when M is a zirconium or titanium, l+m is 4, and l+m is 3 when M is aluminum.

[0082] As an example of a concrete compound of an organic metal chelate compound expressed with the aforementioned general formula (2), it is JIISO propoxy titanium (methyl aceto ASETO), for example.

Iso butoxy CHITANIUMUTORI (methyl acetoacetate)

TORIBUTOKISHICHITANIUMU acetylacetonate JIISOPUROPOKISHI aluminum (methyl aceto acetate)

Dibutoxy titanium screw (ethyl acetoacetate)

Iso butoxy aluminum (acetylacetonate) etc. can be mentioned.

[0083] Next, in the silane coupling agent shown by the aforementioned general formula (3), Q expresses the amino group which may have a halogen atom, a lower alkoxy group, or a substituent, A expresses aryl groups, such as a low-grade alkyl group, a phenyl group, or a naphthyl group, and the organic functional group Y expresses -BOOC(R') C=CH₂, -BNHR", or -BNH₂. R' expresses a low-grade alkyl group, R " of aryl groups, such as a low-grade alkyl group, a phenyl, or a naphthyl group, is expressed, and B expresses the low-grade alkylene machine containing a low-grade alkylene machine or -O-, -NH-, and -CO-. p and q express one or more integers, r expresses zero or more integers, and p+q+r is 4.

[0084] As an example of a concrete compound of a silane coupling agent expressed with the aforementioned general formula (3), gamma-methacryloxypropyl-trimethoxy-silane gamma-methacryloxypropyl triethoxysilane gamma-methacryloxypropylmethyldimethoxysilane etc. can be raised, for example.

[0085] In this invention, an interlayer's thickness has desirable 0.1-10 micrometers, and its 0.1-5 micrometers are especially desirable.

[0086] <Lamination of a photo conductor> The charge generating layer to which the lamination of the photo conductor of this invention contains the charge generating matter (CGM) through an interlayer in a conductive base material (CGL), The composition of having prepared the charge transporting bed (CTL) and surface layer containing the charge transportation matter (coal tar mixture) in this order (as a protective layer) may be used. Moreover, the composition of having prepared CGL and the surface layer which contain CGM through an interlayer in this order (as CTL) may be used. Moreover, the composition of having prepared the surface layer which contains CGM through an interlayer (as a photosensitive layer) may be used, and you may be the composition of having prepared the photosensitive layer and surface layer (considering as a protective layer) which contain both CGM and coal tar mixture through an interlayer further again in this order.

[0087] However, in this invention, especially the composition that prepared CTL and the surface layer containing CGL which contains CGM through an interlayer in a conductive base material from the point

of practicality, and coal tar mixture in this order (as a protective layer) is important.

[0088] Although the above-mentioned surface layer of this invention may serve as CTL as mentioned above, as for these, preparing as another layer is good [the surface layer] as a protective layer on a desirable CTL, CGL, or monolayer type photosensitive layer. In this case, it is still more desirable to prepare a glue line between the above-mentioned photosensitive layer and the surface layer of this invention.

[0089] CGM contained in <<photosensitive layer, and coal-tar-mixture>> As CGM contained in the photosensitive layer of this invention, a phthalocyanine pigment, a polycyclic quinone pigment, an azo pigment, a perylene pigment, an indigo pigment, a Quinacridone pigment, an AZURENIUMU pigment, a SUKUWARIRIUMU color, cyanine dye, a pyrylium color, a thio pyrylium color, xanthene coloring matter, a triphenylmethane dye, styryl coloring matter, etc. are mentioned, for example, and the stratification is performed with a suitable binder resin with such independent or CGM.

[0090] As coal tar mixture contained in the aforementioned photosensitive layer, for example An oxazole derivative, An OKISA diazole derivative, a thiazole derivative, a thiadiazole derivative, A triazole derivative, an imidazole derivative, an imidazolone derivative, an imidazoline derivative, A screw imidazolidine derivative, a styryl compound, a hydrazone compound, a benzidine compound, A pyrazoline derivative, a stilbene compound, an amine derivative, an oxazolone derivative, A benzothiazole derivative, a benzimidazole derivative, a quinazoline derivative, A benzofuran derivative, an acridine derivative, a phenazine derivative, an amino stilbene derivative, Polly N-vinylcarbazole, a Polly 1-vinyl pyrene, a Polly 9-vinyl anthracene, etc. are mentioned, and, as for these coal tar mixture, the stratification is usually performed with a binder resin.

[0091] Binder resin>> of <<photosensitive layer as a binder resin contained in the photosensitive layer of monolayer composition and CGL in laminating composition, and CTL Polycarbonate resin, polyester resin, polystyrene resin, methacrylic resin, Acrylic resin, a polyvinyl chloride resin, a polyvinylidene chloride resin, polyvinyl butyral resin, A polyvinyl-acetate resin, styrene-butadiene resins, the vinylidene-chloride-acrylonitrile copolymer resin, The vinyl chloride-maleic-anhydride copolymer resin, a urethane resin, silicon resin, an epoxy resin, a silicon-alkyd resin, phenol resin, a polysilane resin, a polyvinyl carbazole, etc. are mentioned.

[0092] As for the rate of CGM in CGL, and a binder resin, in this invention, 1:5-5:1 are desirable at a weight ratio. Moreover, the thickness of CGL has desirable 5 micrometers or less, and its 0.05-2 micrometers are especially desirable.

[0093] Moreover, CTL dissolves aforementioned coal tar mixture and an aforementioned binder resin in a suitable solvent, and is formed by carrying out application dryness of the solution. As for the mixed rate of coal tar mixture and a binder resin, 3:1-1:3 are desirable at a weight ratio.

[0094] Moreover, when especially the thickness of CTL has desirable 10-40 micrometers 5-50 micrometers and two or more CTL(s) are prepared, as for the thickness of the upper layer of two or more of these CTL(s), it is desirable that 10 micrometers or less are smaller than all the thickness of CTL preferably prepared in the bottom of the upper layer of two or more of these CTL(s).

[0095] << -- the solvent for photosensitive layers, and dispersant>> -- as the solvent used for the photosensitive layer of the photo conductor of this invention, an interlayer, a protective layer, etc., or a dispersant N butylamine, a diethylamine, ethylenediamine, an isopropanolamine, A triethanolamine, a triethylenediamine, N.N-dimethylformamide, An acetone, a methyl ethyl ketone, methyl isopropyl ketone, a cyclohexanone, Benzene, toluene, a xylene, chloroform, a dichloromethane, 1, 2-dichloroethane, 1, 2-dichloropropane, 1 and 1, 2-trichloroethane, 1 and 1, 1-trichloroethane, A trichloroethylene, a tetrachloroethane, a tetrahydrofuran, a dioxolane, a dioxane, a methanol, ethanol, a butanol, an isopropanol, ethyl acetate, butyl acetate, dimethyl sulfoxide, a methyl cellosolve, etc. are mentioned. Although this invention is not limited to these, a dichloromethane, 1, 2-dichloroethane, a methyl ethyl ketone, etc. are used preferably. Moreover, these solvents can also be used as independent or two or more sorts of partially aromatic solvents.

[0096] <<conductivity base material>> What next prepared the layer of conductive compounds, such as conductive polymer, indium oxide, and a tin oxide, by an application or vacuum evaporation as a

conductive base material of the electrophotography photo conductor of this invention on base materials, such as what prepared metal thin layers, such as aluminum, palladium, and gold, by a lamination or vacuum evaporation on base materials, such as metal plates, such as 1 aluminum plate and a stainless steel board, 2 paper, or plastic film, 3 paper, or plastic film, is mentioned.

[0097] As a material of a conductive base material used by this invention, what carried out the fabricating operation of metallic materials, such as aluminum, copper, brass, steel, and stainless steel, and the other plastic material mainly to the shape of the shape of a belt and a drum is used. The aluminum which was excellent in cost, processability, etc. especially is used preferably, and many light-gage circle tubed aluminum element tubes by which extrusion molding or drawing-out molding was usually carried out are used.

[0098] Moreover, the shape of the shape of a drum, the shape of a sheet, and a belt has as the configuration of a base material, and it is desirable that it is the configuration which carried out the optimal to the electrophotography equipment to apply.

[0099] <<application processing method>> As the application processing method for next manufacturing the electrophotography photo conductor of this invention, although the application processing methods, such as a dip painting cloth, a spray application, and a circular amount regulation type application, are used As for application processing by the side of the surface layer of a photosensitive layer, it is desirable to use the application processing methods, such as a spray application or a circular amount regulation type (for circular slide hopper type to be the example of representation) application, in order not to dissolve a lower layer film as much as possible, and in order to attain uniform application processing. In addition, it is indicated in detail by JP,3-90250,A and JP,3-269238,A, and the aforementioned spray application is indicated in detail about the aforementioned circular amount regulation type application at JP,58-189061,A.

[0100] In this invention, the conductive layer aiming at covering further for compensating with the surface discontinuity of a base material between a base material and an interlayer, preventing generating of the interference fringe which poses a problem when especially a picture input is a laser beam, etc. can be prepared. Application dryness of this conductive layer can be carried out, and it can form the solution which distributed conductive fine particles, such as carbon black, metal particles, or a metallic-oxide particle, in the suitable binder resin. The thickness of a conductive layer has desirable 5-40 micrometers, and its 10-30 micrometers are especially desirable.

[0101] <Image formation equipment and process cartridge> Although the photo conductor of this invention can be applied to the general image formation equipment of electrophotography methods, such as a copying machine, a LASER beam printer, an LED printer, and a liquid crystal shutter formula printer, it can be widely applied also to image formation equipments, such as the display and record which applied electrophotographic technology further, inplant printing, platemaking, and facsimile.

[0102] The cross section of the image formation equipment which has the photo conductor of this invention in drawing 1 is shown.

[0103] In drawing 1, 10 applies a photosensitive layer to drum lifting, it is the photo conductor which painted the surface layer (protective layer) of this invention on it, and it is a photo conductor drum and drive rotation is clockwise carried out [it is grounded and]. 12 is the electrification machine of scorotron and uniform electrification is given to it by corona discharge to photo conductor drum 10 peripheral surface. In advance of electrification with this electrification machine 12, in order to abolish the history of the photo conductor in pre- image formation, exposure by the exposure section 11 which used light emitting diode (Light Emitting Diode) etc. may be performed, and a photo conductor peripheral surface may be discharged.

[0104] After being uniform charged to a photo conductor, image exposure based on the picture signal is performed by the image photographic filter 13. The image photographic filter 13 of this drawing uses as the exposure light source the laser or Light Emitting Diode which is not illustrated. The scan of photo conductor drum lifting is made by the light which had the optical path bent by the reflective mirror 132 through the rotating polygon mirror 131, ftheta lens, etc., and an electrostatic latent image is formed.

[0105] Subsequently the electrostatic latent image is developed with a development counter 14. The

development counter 14 which contained the developer which consists of a toner and carriers, such as yellow (Y), a Magenta (M), cyanogen (C), and black (K), respectively is formed in photo conductor drum 10 periphery, and first, the development of one amorous glance builds in a magnet and is performed by the development sleeve 141 which holds a developer and is rotated. By making into the main material the carrier which the developer used the ferrite as the core and coated the surroundings of it with the insulating resin, and polyester, it does not consist of a pigment according to the color, and a toner which added an electric charge control agent, a silica, titanium oxide, etc., and a developer is regulated on the development sleeve 141 by the layer means forming which is not illustrated at 100-600-micrometer thickness, it is conveyed in a development region, and development is performed. At this time, development is usually performed between the photo conductor drum 10 and the development sleeve 141, applying a direct current and/or AC-bias voltage.

[0106] In color picture formation, after development of one amorous glance finishes, it is needed for the image formation distance of two amorous glance, and uniform electrification with the scorotron electrification machine 12 is performed again, and the latent image of two amorous glance is formed of the image photographic filter 13. The image formation distance same also about three amorous glance and four amorous glance as two amorous glance is performed, and **** of four colors is formed on photo conductor drum 10 peripheral surface. On the other hand, with the image formation equipment of the electrophotography method of monochrome, a development counter 14 consists of one sort of black toners, and can form a picture in one development.

[0107] After image formation, the recording paper P is fed to an imprint region by the rotation operation of the feed roller 17, when the timing of an imprint is ready.

[0108] The recording paper P with which the pressure welding of the imprint roller (imprint machine) 18 was carried out to the peripheral surface of the drum-like photo conductor 10, and it was fed to it in the imprint region synchronizing with the timing of an imprint is fastened, and it is collectively imprinted by the multicolor image.

[0109] Subsequently, electric discharge is made by the eliminator 19 made into the pressure-welding state almost simultaneously with an imprint roller, the peripheral surface of the drum-like photo conductor 10 separates, and the recording paper P is conveyed by fixing equipment 20, and after it welds a toner by heating of the heat roller 201 and the sticking-by-pressure roller 202 and pressurization, it is discharged by the equipment exterior through the delivery roller 21. in addition, the aforementioned imprint roller 18 and an aforementioned eliminator 19 -- the peripheral surface of the photo conductor 10 of the shape of a passage rear drum of the recording paper P -- evacuation -- alienation -- carrying out -- a degree -- it prepares for formation of a toner image

[0110] electric discharge the photo conductor 10 of the shape of a drum after separating the recording paper P on the other hand removes and cleans a remains toner with the pressure welding of the blade 221 of the cleaning machine 22, and according to the exposure section 11 again, and electrification with the electrification machine 12 -- receiving -- a degree -- it goes into the process of image formation In addition, in piling up and forming a color picture on a photo conductor, the aforementioned blade 221 moves immediately after cleaning of a photo conductor side, and it evacuates it from the peripheral surface of the drum-like photo conductor 10.

[0111] In addition, 30 is a removable process cartridge which is having the photo conductor, the electrification machine, an imprint machine and an eliminator, and the cleaning machine unified.

[0112] As image formation equipment of an electrophotography method, it may combine with one, and may constitute by using the photo conductor of the shape of an above-mentioned drum, and the component of a development counter, a cleaning machine, etc. as a process cartridge, and this unit may be constituted free [attachment and detachment] to the main part of equipment. Moreover, in support of at least one of an electrification machine, an image photographic filter, a development counter, an imprint or an eliminator, and the cleaning machines, a process cartridge is formed in one with a photo conductor, and it considers as the single unit which can be freely detached and attached on the main part of equipment, and is good also as composition which can be detached and attached freely using guidance meanses, such as a rail of the main part of equipment.

[0113] When using image formation equipment as a copying machine or a printer, image exposure reads and signal-izes a manuscript by irradiating the reflected light and the transmitted light from a manuscript at a photo conductor, or the sensor, and is performed by performing the scan of a laser beam, the drive of an LED array, or the drive of a liquid crystal shutter array according to this signal, and irradiating light at a photo conductor etc.

[0114] In addition, when using it as a printer of facsimile, the image photographic filter 13 will perform exposure for printing received data.

[0115]

[Example] Although an example is given and this invention is explained in detail hereafter, the mode of this invention is not limited to this.

[0116]

Example 1 <production of photo conductor of example 1> <<interlayer>>

Zirconium chelate compound "ZC-540" (the Matsumoto Pharmaceuticals company make)

200g Silane coupling agent "KBM-903" (the Shin-etsu chemistry company make) 100g Methanol 700ml

Ethanol The dip painting cloth of the above-mentioned constituent was carried out on the 300ml drum-like aluminum base material, 150 degrees C dried for 30 minutes, and the interlayer with a thickness of 1.0 micrometers was formed.

[0117]

<<CGL>>

CGM of the following structure (C1) 60g The 15% xylene-butanol solution of silicone resin "KR5240" (the Shin-etsu chemistry company make) 700g Methyl ethyl ketone The 2000ml above-mentioned constituent was mixed, it distributed for 10 hours using the sand mill, and CGL application liquid was prepared. This application liquid was applied by the dip painting cloth method on the aforementioned interlayer, and CGL of 0.2 micrometers of thickness was formed.

[0118]

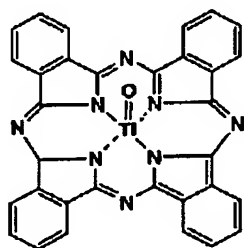
<<CTL>>

coal tar mixture of the following structure (D1) 200g Bisphenol Z type polycarbonate "the you pyrone Z300" (Mitsubishi Gas Chemical Co., Inc. make) 300g 1, 2-dichloroethane 2000ml was mixed, it dissolved and CTL application liquid was prepared. This application liquid was applied by the dip painting cloth method after Above CGL, and CTL of 20 micrometers of thickness was formed.

[0119]

[Formula 38]

CGM(C1)

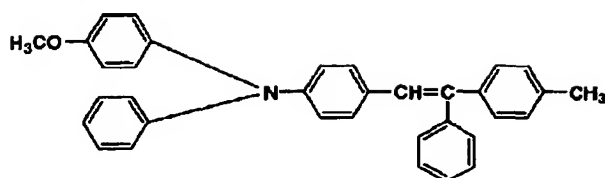


[0120] However, in the X diffraction view using the characteristic X ray of CuKalpha, it is the oxy-titanium phthalocyanine which Bragg's angle ($2\theta \times 0.2$ degree) has the maximum peak at 27.3 degrees, in addition has at least one peak at 9.5 degrees, 11.6 degrees, 15.0 degrees, and 24.1 degrees.

[0121]

[Formula 39]

CTM(D1)



[0122] Diluted the primer "PC-7J" (the Shin-etsu chemistry company make) of marketing besides with toluene to double precision, it was made to dry for 30 minutes at 100 degrees C after an application, and the glue line of 0.3 micrometers of dryness thickness was formed.

[0123] The commercial dehydrating agent "molecular-sieve 4A" (product made from Wako Pure Chem Manufacture) was added in the polysiloxane resin (1% of the weight of silanol group is included) 10 weight section which besides consists of 20 mol % of 80 mol % and methyl-phenyl siloxane units of methyl siloxane units, it put for 15 hours and dehydration processing was carried out. This resin was dissolved in the toluene 10 weight section, the methyl trimetoxysilane 5 weight section and the dibutyl tin acetate 0.2 weight section were added to this, and it was made the uniform solution.

[0124] The triaryl amine type charge transportability compound (instantiation compound T-1) 6 weight section was added to this, it mixed, this solution was applied as a surface layer (protective layer) of 1 micrometer of dryness thickness, dryness of 1 hour was performed at 120 degrees C, and the photo conductor of an example 1 was produced.

[0125] Replaced with the triaryl amine type charge transportability compound (instantiation compound T-1) in the protective layer of the photo conductor of the example 2 <production of photo conductor of example 2> example 1, and the triaryl amine type charge transportability compound (instantiation compound T-14) was used, and also the photo conductor of an example 2 was produced similarly.

[0126] Replaced with the triaryl amine type charge transportability compound (instantiation compound T-1) in the protective layer of the photo conductor of the example 3 <production of photo conductor of example 3> example 1, and the triaryl amine type charge transportability compound (instantiation compound T-15) was used, and also the photo conductor of an example 3 was produced similarly.

[0127] Evaluation of the photo conductor of examples 1-3 carried this photo conductor in Konica7050 (digital copier by Konica Corp.), set it as initial electrification potential-650V, and performed the image formation test. That is, when first stage and picture evaluation of 100,000 sheets was performed using A4 paper to the bottom of 20-degree-C60%RH and the 30-degree-C80%RH environment, the first stage and all 100,000 fogging were also generated in neither of the environmental conditions, and the picture 1.2 or more concentration was obtained by reflection density, and the concentration of the black solid section excelled [picture] in homogeneity was acquired. Moreover, there was also very little abrasion loss of the photo conductor at the 100,000-sheet end time as 0.1 micrometers or less. furthermore, the crack on the front face of a photo conductor looks at almost -- not having -- a halftone picture top -- a pickpocket -- the picture defect by the blemish was not seen Moreover, ablation of a photosensitive layer was not seen, either.

[0128] The triaryl amine type charge transportability compound (instantiation compound T-1) in the protective layer in the photo conductor of the example 1 <production of photo conductor of example 1 of comparison> example 1 of comparison was replaced with 4-[2-(triethoxy silyl) ethyl] triphenylamine, and also the photo conductor of the example 1 of comparison was produced similarly.

[0129] Although the good picture was acquired in the environment of 20-degree-C60%RH as a result of evaluating the photo conductor of the example 1 of comparison like the case of the photo conductor of the aforementioned example 1, in 30-degree-C80%RH, fogging occurred by the picture of 70,000 sheets, and picture dotage occurred by a part of picture.

[0130] The interlayer of the photo conductor of the example 4 <production of photo conductor of example 4> example 1 was replaced with the following material, and also the photo conductor of an example 4 was produced similarly.

[0131]

Silane coupling agent "KBM-903" (the Shin-etsu chemistry company make) 300g Water 30ml Ethanol 1000ml of polysiloxane resins in the protective layer of the photo conductor of an example 1 was replaced with the polysiloxane resin (2% of the weight of a silanol group is included) which consists of 20 mol % of 80 mol % and dimethylsiloxane units of methyl siloxane units again, and also the photo conductor of an example 4 was produced similarly.

[0132] The interlayer of the photo conductor of the example 2 <production of photo conductor of example 2 of comparison> example 1 of comparison was replaced with the following material, and also the photo conductor of the example 2 of comparison was produced similarly.

[0133]

Polyamide resin "CM-8000" Toray Industries, Inc. make 15g 2-propanol 150ml Methanol Although the good picture was acquired in the environment of 20-degree-C60%RH as a result of evaluating the photo conductor of the example 2 of 850ml comparison like the case of the photo conductor of an example 1, in 30-degree-C80%RH, the reflection density of the black solid section fell to 1.0 by the picture of 60,000 sheets, and picture dotage occurred by a part of picture. Moreover, ablation of a photosensitive layer was looked at by a part of photosensitive layer after a 100,000-sheet end.

[0134] The polysiloxane resin of the protective layer of the photo conductor of the example 5 <production of photo conductor of example 5> example 1 was replaced with the polysiloxane resin (2% of the weight of a silanol group is included) which consists of ten mol % of 30 mol siloxane [20 mol % / of 40 mol % / of % and ethyl siloxane units /, and dimethylsiloxane units /, and diethyl] units of methyl siloxane units, and also the photo conductor of an example 5 was produced similarly.

[0135] The polysiloxane resin of the protective layer of the photo conductor of the example 6 <production of photo conductor of example 6> example 1 was replaced with the polysiloxane resin (2% of the weight of a silanol group is included) which consists of 20 mol % of 30 mol siloxane [20 mol % / of 30 mol % / of % and phenyl siloxane units /, and dimethylsiloxane units /, and diethyl] units of methyl siloxane units, and also the photo conductor of an example 6 was produced similarly.

[0136] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 7 <production of photo conductor of example 7> example 1 was replaced with the hydrazone type charge transportability compound (instantiation compound H-1), and also the photo conductor of an example 7 was produced similarly.

[0137] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 8 <production of photo conductor of example 8> example 1 was replaced with the hydrazone type charge transportability compound (instantiation compound H-5), and also the photo conductor of an example 8 was produced similarly.

[0138] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 9 <production of photo conductor of example 9> example 1 was replaced with the stilbene type charge transportability compound (instantiation compound S -1), and also the photo conductor of an example 9 was produced similarly.

[0139] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 10 <production of photo conductor of example 10> example 1 was replaced with the stilbene type charge transportability compound (instantiation compound S -4), and also the photo conductor of an example 10 was produced similarly.

[0140] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 11 <production of photo conductor of example 11> example 1 was replaced with the stilbene type charge transportability compound (instantiation compound S -8), and also the photo conductor of an example 11 was produced similarly.

[0141] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 12 <production of photo conductor of example 12> example 1 was replaced with the benzidine type charge transportability compound (instantiation compound Be-1), and also the photo conductor of an example 12 was produced similarly.

[0142] The triaryl amine type charge transportability compound (instantiation compound T-1) of the

protective layer of the photo conductor of the example 13 <production of photo conductor of example 13> example 1 was replaced with the benzidine type charge transportability compound (instantiation compound Be-4), and also the photo conductor of an example 13 was produced similarly.

[0143] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 14 <production of photo conductor of example 14> example 1 was replaced with the benzidine type charge transportability compound (instantiation compound Be-6), and also the photo conductor of an example 14 was produced similarly.

[0144] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 15 <production of photo conductor of example 15> example 1 was replaced with the butadiene type charge transportability compound (instantiation compound Bu-1), and also the photo conductor of an example 15 was produced similarly.

[0145] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 16 <production of photo conductor of example 16> example 1 was replaced with other charge transportability compound instantiation compounds (So-1), and also the photo conductor of an example 16 was produced similarly.

[0146] The triaryl amine type charge transportability compound (instantiation compound T-1) of the protective layer of the photo conductor of the example 17 <production of photo conductor of example 17> example 1 was replaced with other charge transportability compound instantiation compounds (So-3), and also the photo conductor of an example 17 was produced similarly.

[0147] It replaced with the interlayer of the photo conductor of the example 18 <production of photo conductor of example 18> example 1, the dip painting cloth of the application liquid which carried out stirring mixture and obtained the following constituent was carried out on the base material, it was dried for 30 minutes 150 degrees C, the interlayer with a thickness of 1.0 micrometers was formed and the same CGL as an example 1, CTL, and the glue line were formed on this interlayer.

[0148]

A titanium chelate compound "TC-750" (the Matsumoto Pharmaceuticals company make) 200g Silane coupling agent "KBM-503" (the Shin-etsu chemistry company make) 130g 2-propanol 1000ml Water Subsequently to the above-mentioned glue-line top, 30ml The commercial hardenability siloxane resin "KP-854" (Shin-etsu chemistry company make) 60 weight section, Add the isopropanol 60 weight section, dissolve uniformly, and the application liquid which mixed and obtained the triaryl amine type charge transportability compound (instantiation compound T-1) 6 weight section like the example 1 is applied. Dryness of 120 degree C and 1 hour was performed, the protective layer of 1 micrometer of dryness thickness was formed, and the photo conductor of an example 18 was produced.

[0149] The photo conductor of an example 19 was completely similarly produced except having used the siloxane resin "X-40-2239" (the Shin-etsu chemistry company make) for the photo conductor of the example 19<example 19 instead of the siloxane resin "KP-854" of the protective layer of the production> example 18.

[0150] It replaced with the interlayer of example 20 example 18, the dip painting cloth of the application liquid which carried out stirring mixture and obtained the following constituent was carried out on the base material, it was dried for 30 minutes 150 degrees C, the interlayer with a thickness of 1.0 micrometers was formed and the same CGL as an example 1, CTL, and the glue line were formed on this interlayer.

[0151]

A titanium chelate compound "TC-100" (the Matsumoto Pharmaceuticals company make) 200g Silane coupling agent "KBM-903" (the Shin-etsu chemistry company make) 130g Toluene 1000ml Water Subsequently to instead of the siloxane resin "KP-854" of an example 18, except having used the siloxane resin "X-40-2269" (the Shin-etsu chemistry company make) on the above-mentioned glue line, the protective layer was completely formed similarly and 30ml of photo conductors of an example 20 was produced.

[0152] Evaluation of the photo conductor of examples 4-20 was performed like the case of the photo conductor of an example 1, and the first stage and all 100,000 fogging were also generated in neither of

the environmental conditions under 20-degree-C60%RH and the 30-degree-C80%RH environment, and the picture 1.2 or more concentration was obtained by reflection density, and the concentration of the black solid section excelled [picture] in homogeneity was acquired. Moreover, there was also very little abrasion loss of the photo conductor at the 100,000-sheet end time as 0.1 micrometers or less.

furthermore, the crack on the front face of a photo conductor looks at almost -- not having -- a halftone picture top -- a pickpocket -- the picture defect by the blemish was not seen Moreover, ablation of a photosensitive layer was not seen, either.

[0153] The photo conductor of an example 21 was similarly produced except having added the hindered phenolic compound (instantiation compound 1-32) 0.9 weight section to the protective layer of the photo conductor of example 21 example 1.

[0154] To the protective layer of the photo conductor of example 22 example 1, the photo conductor of an example 22 was similarly produced except having added the hindered phenol amine compound (instantiation compound 2-1) 0.6 weight section.

[0155] The photo conductor of examples 21 and 22 was evaluated like the case of the photo conductor of an example 1.

[0156] The first stage and all 100,000 fogging were also generated in neither of the environmental conditions under 20-degree-C60%RH and the 30-degree-C80%RH environment, and the picture 1.3 or more concentration was obtained by reflection density, and the concentration of the black solid section excelled [picture] in homogeneity was acquired. Moreover, there was also very little abrasion loss of the photo conductor at the 100,000-sheet end time as 0.1 micrometers or less. furthermore, the crack on the front face of a photo conductor looks at almost -- not having -- a halftone picture top -- a pickpocket -- the picture defect by the blemish was not seen Moreover, ablation of a photosensitive layer was not seen, either. In addition, in the photo conductor of examples 21 and 22, the clear picture was acquired by high concentration as compared with the photo conductor of the examples 1-20 which this antioxidant contains and are not in a protective layer since the antioxidant contains.

[0157] the case where the photo conductor of an example performs image formation which amounts to 100,000 times repeatedly under high-humidity/temperature from examples 1-22 and the examples 1 and 2 of comparison -- the thickness abrasion loss of a photo conductor -- few -- generating of fogging, picture dotage and film peeling, a blemish, etc. -- there is nothing -- high concentration -- although a clear picture is acquired, it turns out that it is bad those any they are and the photo conductor of the example of comparison is lacking in practicality

[0158]

[Effect of the Invention] As proved by the example, even when the degree of hardness on the front face of a photosensitive layer is high, it excels in abrasion resistance, and****-proof and an adhesive property, image formation is performed repeatedly and image formation performed repeatedly under high-humidity/temperature especially according to the photo conductor, the process cartridge using it, and the image-formation equipment of this invention, defatigation degradation of an electrophotography performance does not produce, and neither fogging, nor picture dotage, etc. do not produce, but it has the effect which is [acquire / a good picture is stabilized and] excellent.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] Although the inorganic photo conductor containing the inorganic photoconductivity matter was conventionally used for the electrophotography photo conductor, many organic photo conductors which replace with an inorganic photo conductor in recent years, and contain the organic photoconductivity matter came to be used. In the above-mentioned organic photo conductor (henceforth a photo conductor), it is easy to develop the material corresponding to the various exposure light sources from the light to infrared light, although there are many points of having excelled as compared with the inorganic photo conductor -- that material without environmental pollution can be chosen and a manufacturing cost is cheap -- the only fault -- a mechanical strength -- weak -- many -- it is that wear a photosensitive-layer front face out, are damaged at the time of the copy of several sheets, or a print, and an electrophotography performance tends to deteriorate

[0003] Since electric and mechanical external force is applied directly, the wear damage of the front face of the above-mentioned photo conductor is easy to be carried out with an electrification machine, a development counter, an imprint machine, an eliminator, a cleaning vessel, etc., and the improvement of endurance to them is demanded. Specifically, the improvement of mechanical endurance to film peeling by wear on the front face of a photo conductor by ****, generating of a blemish, mixing of a foreign matter, the shock at the time of paper jam processing, etc. is demanded. About the endurance over the blemish and film peeling by the shock, about the same intensity as an inorganic photo conductor is called for strongly especially. Moreover, the endurance over degradation of the photo conductor front face by ozone, active oxygen, etc. which are generated at the time of corona electrical charging etc. is also demanded.

[0004] In order to fulfill various properties requested from the above photo conductor front faces, the former various improvement method is proposed. That is, it is reported by by using a BPZ polycarbonate as a binder resin on the surface of a photo conductor that a surface wear property, a toner filming property, etc. are improved. Moreover, using the hardenability silicone resin containing colloidal silica for the protective layer of the front face of a photo conductor is reported by JP,6-118681,A.

[0005] However, in the photo conductor using the BPZ polycarbonate as a binder resin, in addition, antiwear characteristics run short and it does not have satisfying endurance. Although improved, the electrophotography property at the time of repeat use was inadequate, at the time of repeat use, it was easy to generate fogging and picture dotage, and the endurance of the surface layer of the hardenability silicone resin which contains colloidal silica on the other hand was inadequate [the antiwear characteristic].

[0006] As a method of improving such a fault, the photo conductor which has the resin layer which combined the electron hole transportability compound in the hardenability organic Si system macromolecule as a surface layer is proposed by JP,9-124943,A and JP,9-190004,A. However, this resin layer does not have sufficient endurance that it is easy to generate fogging and picture dotage under a high-humidity environment. Moreover, there was a fault, like such a hardenability organic Si compound film tends to produce film peeling of a photosensitive layer in although abrasion resistance is high, if a blemish tends to be attached to an external shock, and the film intensity of a photosensitive layer and the

adhesive property were inadequate.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section of image formation equipment.

[Description of Notations]

- 10 Photo Conductor Drum
- 12 Electrification Machine
- 13 Image Photographic Filter
- 14 Development Counter
- 18 Imprint Roller
- 19 Eliminator
- 20 Fixing Equipment
- 22 Cleaning Machine
- 30 Process Cartridge

[Translation done.]

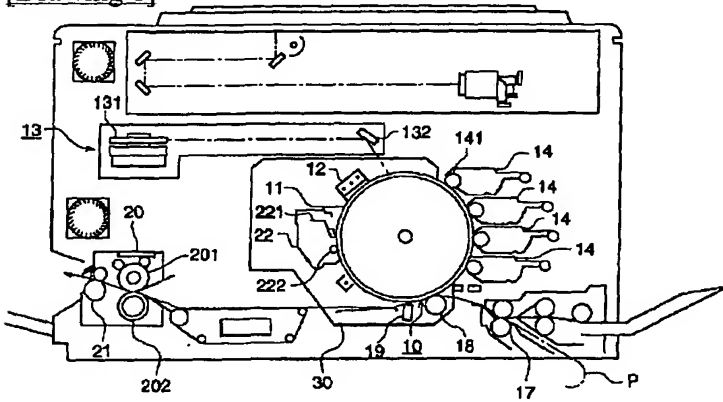
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DRAWINGS

[Drawing 1]



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